Cisco ASR 9001 and Cisco ASR 9001-S Routers Hardware Installation Guide

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Cisco ASR 9001 and Cisco ASR 9001-S Routers Hardware Installation Guide

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Preface

This *Cisco ASR 9001 and Cisco ASR 9001-S Routers Hardware Installation Guide* preface contains these sections:

Changes to This Document

Table 1 lists the technical changes made to this document since it was first developed.

Table 1 Changes to This Document

Revision	Date	Change Summary
OL-26701-02	May 2013	Added information about Cisco ASR 9001-S Router.
OL-26701-01	June 2012	Initial release of this document.

Audience

This *Cisco ASR 9001 and Cisco ASR 9001-S Routers Hardware Installation Guide* is written for hardware installers and system administrators of Cisco routers.

These users must have a substantial background in installing and configuring router and switch-based hardware. Also, they should be familiar with electronic circuitry and wiring practices, and have experience as an electronic or electromechanical technician.

Purpose

This installation guide contains procedures for installing the router hardware, creating a basic startup configuration file, and powering the router on for the first time.

Document Organization

This installation guide is organized into these chapters and appendixes:

- Chapter 1, "Preparing for Installation," describes safety considerations, required tools and equipment, an overview of the installation, and procedures to perform before installation.
- Chapter 2, "Unpacking and Installing the Chassis," provides instructions for installing the chassis into a rack.
- Chapter 3, "Installing Modules and Cables in the Chassis," provides instructions for installing the cards and modules into the chassis after it is mounted in a rack, and for connecting external network interface cables.
- Chapter 4, "Troubleshooting the Installation," provides guidelines for troubleshooting the router hardware installation.
- Chapter 5, "Replacing Cisco ASR 9001 Router Components," provides removal and replacement procedures for primary router components and field-replaceable units (FRUs).
- Appendix A, "Technical Specifications," provides a summary of physical, electrical, and environmental specifications for the router.
- Appendix B, "Site Log," provides a sample site log that can be used to record actions relevant to the operation and maintenance of the router.

Document Conventions

This publication uses these conventions:

- **Ctrl** represents the key labeled *Control*. For example, the key combination **Ctrl-Z** means hold down the **Control** key while you press the **Z** key.

Command descriptions use these conventions:

- Examples that contain system prompts denote interactive sessions, indicating the commands that you should enter at the prompt. For example:

  ```
  RP/0/RSP0/CPU0:router#
  ```

- Commands and keywords are in **bold** font.
- Arguments for which you supply values are in *italic* font.
- Elements in square brackets ([ ]) are optional.
- Alternative but required keywords are grouped in braces ({ }) and separated by vertical bars (|).

Caution Means *be careful*. You are capable of doing something that might result in equipment damage or loss of data.

Note Means *take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Warning **This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, see the *Regulatory Compliance and Safety Information* document that accompanied this device.**

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

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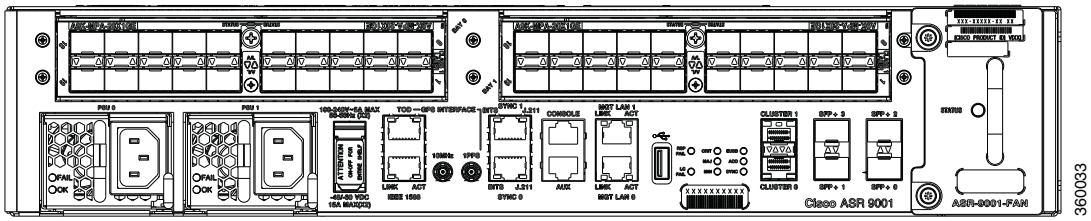
CHAPTER 1

Preparing for Installation

Cisco ASR 9001 Router

The Cisco ASR 9001 Router is a compact high-capacity provider edge (PE) router that delivers 120 Gbps of non-blocking, full-duplex fabric capacity in a two-rack-unit (2RU) form factor. Similar to other routers in the Cisco ASR 9000 Series, running Cisco IOS XR software images, the Cisco ASR 9001 Router delivers the features and services found on the ASR 9000 Series platforms, allowing customers to standardize on the same Cisco IOS XR image. The Cisco ASR 9001 Router has an integrated route processor (RP) and two modular bays that support 1 GE and 10 GE modular port adapters (MPAs). The base chassis has four integrated 10 GE enhanced small form-factor pluggable (SFP+) ports, a GPS input for stratum-1 clocking, building integrated timing supply (BITS) ports, and management ports. Figure 1-1 shows the front panel of the Cisco ASR 9001 Router.

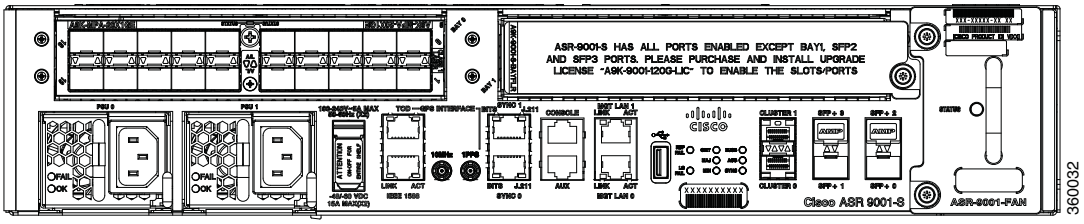
Figure 1-1 Front Panel of the Cisco ASR 9001 Router



Cisco ASR 9001-S Router

The Cisco ASR 9001-S Router is a 60 Gbps variant of the Cisco ASR 9001 Router. Similar to other routers in the Cisco ASR 9000 Series, running Cisco IOS XR software images, the Cisco ASR 9001-S Router delivers the features and services found on the ASR 9000 Series platforms, allowing customers to standardize on the same Cisco IOS XR image. The Cisco ASR 9001-S Router comes standard with one modular bay (BAY 0) that supports either a 1 GE, 10 GE, or 40 GE modular port adapters (MPAs). The chassis also comes usable with two fixed SFP+ ports (SFP+0 and SFP+1). The second MPA slot (BAY 1) and other two SFP+ ports (SFP+2 and SFP+3) are disabled and covered with dust caps by default. It supports the same set of features and scaling for each NPU as does the Cisco ASR 9001 Router. Figure 1-2 shows the front panel of the Cisco ASR 9001-S Router.

Figure 1-2 Front Panel of the Cisco ASR 9001-S Router



In order to achieve the full bandwidth of 120 Gbps and to enable the disabled ports, a Cisco license can be obtained. Once the license is obtained and installed, the Cisco ASR 9001-S Router must be reloaded to bring up the full 120 Gbps capacity. For information on configuring the Cisco license for Cisco ASR 9001-S Router, refer to the *Cisco ASR 9001-S 120G Upgrade License Configuration Guide*.

Note The Cisco ASR 9001-S Router follows the same hardware installation procedure as the procedure for the Cisco ASR 9001 Router, described in this document.

This chapter guides you through the process of preparing for router installation.

Before installing your Cisco ASR 9001 Router, you must consider these requirements:

- power and cabling requirements must be in place at your installation site
- special equipments must be available for installing the router
- the environmental conditions that your installation site must meet to maintain normal operation

The shipping package for the router is engineered to reduce chances of product damage that may result from routine material handling during shipment:

- Keep the router in the shipping container until you have determined the installation site.
- The router should always be transported or stored in its shipping package in the upright position.

Inspect all items for shipping damage. If an item appears damaged, contact a Cisco customer service representative immediately.

This chapter contains these installation topics:

Safety Guidelines

Before you perform any procedure in this publication, you must review the safety guidelines in this section to avoid injuring yourself or damaging the equipment.

Note that this section contains guidelines, and do not include every potentially hazardous situation. When you install a router, always use caution and common sense.

General Safety Guidelines

- Never attempt to lift an object that might be too heavy for you to lift by yourself.

- Always disconnect the power source and unplug all power cables before lifting, moving, or working on the router.
- Keep the work area clear and dust free during and after installation.
- Keep tools and router components away from walkways and equipment rack aisles.
- Do not wear loose clothing, jewelry (including rings and chains), or other items that could get caught in the router.
- Fasten your tie or scarf and sleeves.
- Operate Cisco equipment safely by using it in accordance with its electrical ratings and product usage instructions.
- Do not work alone if potentially hazardous conditions exist.
- Always unplug power cables when performing maintenance or working on the router, unless the replacement part is hot swappable and designed for online insertion and removal (OIR).
- Ensure that the installation of the router is in compliance with national and local electrical codes: in the United States, National Fire Protection Association (NFPA) 70, United States National Electrical Code; in Canada, Canadian Electrical Code, part I, CSA C22.1; in other countries, International Electrotechnical Commission (IEC) 364, part 1 through part 7.

Compliance and Safety Information

Both the Cisco ASR 9001 Router and the Cisco ASR 9001-S Router are designed to meet the regulatory compliance and safety approval requirements. See *Regulatory Compliance and Safety Information for Cisco 12000 Series Routers.*

Laser Safety

The line card ports in Cisco ASR 9001 Router are equipped with lasers. The lasers emit invisible radiation. Do not stare into open line card ports. Observe this warning to prevent eye injury:

Warning **Because invisible laser radiation may be emitted from the aperture of the port when no cable is connected, avoid exposure to laser radiation and do not stare into open apertures.** Statement 70

Energy Hazard

The Cisco ASR 9001 Router can be configured for a DC power source. Do not touch terminals while they are live. Observe this warning to prevent injury.

Warning **Hazardous voltage or energy may be present on power terminals. Always replace cover when terminals are not in service. Be sure uninsulated conductors are not accessible when cover is in place.** Statement 1086

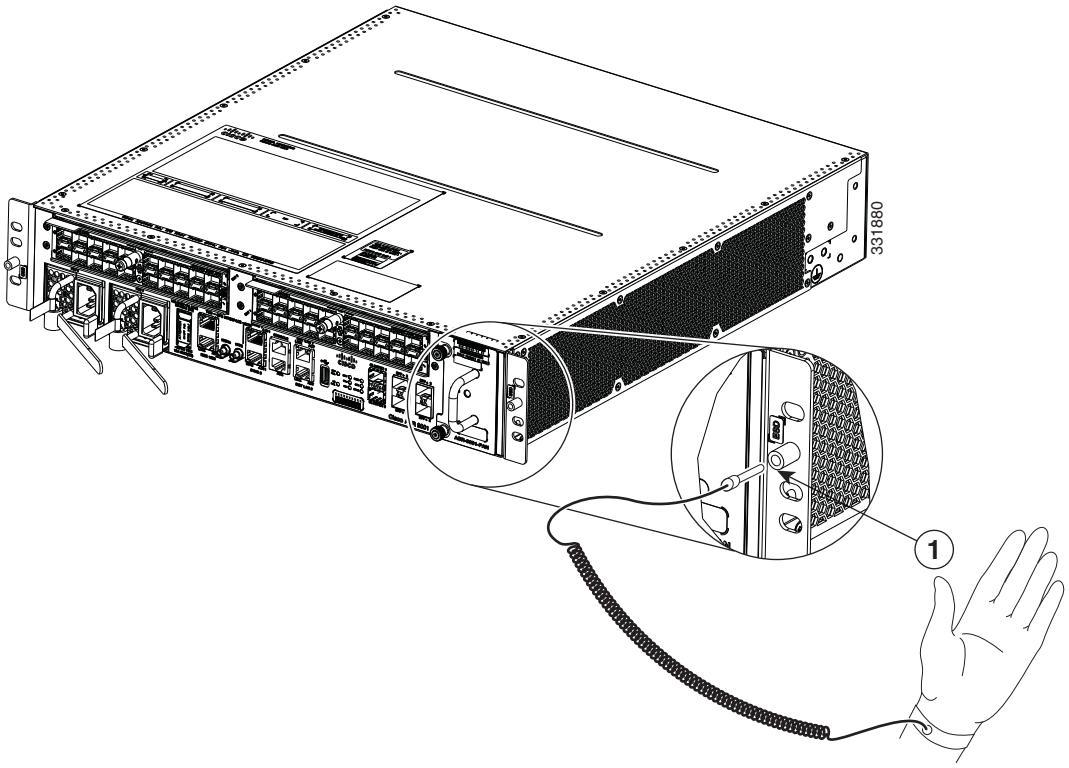
Preventing Electrostatic Discharge Damage

Many router components can be damaged by static electricity. Not exercising the proper electrostatic discharge (ESD) precautions can result in intermittent or complete component failures. To minimize the potential for ESD damage, always use an ESD-preventive antistatic wrist strap (or ankle strap) and ensure that it makes good skin contact.

Note Check the resistance value of the ESD-preventive strap periodically. The measurement should be between 1 and 10 megohms.

Before you perform any procedure in this guide, attach an ESD-preventive strap to your wrist and connect the leash to the chassis as shown in Figure 1-3.

Figure 1-3 Connecting an ESD-Preventive Wrist Strap to the Cisco ASR 9001 Router Chassis



1	Location of chassis socket for ESD strap on the Cisco ASR 9001 Router

Lifting Guidelines

A fully-configured Cisco ASR 9001 Router can weigh as much as 37.91 pounds (17.2 kg). These systems are not intended to be moved frequently. Before you install the router, ensure that you have planned the installation and migration of the router into your network so that you can avoid having to move the router later to accommodate power sources and network connections.

Use these lifting guidelines to avoid injury to yourself or damage to the equipment:

- Do not lift equipment alone; have another person help you to lift the equipment.
- Ensure that your footing is solid; balance the weight of the object between your feet.
- Lift the equipment slowly; never move suddenly or twist your body as you lift.
- Keep your back straight and lift with your legs, not your back. When bending down to lift equipment, bend at the knees (not at the waist), to reduce the strain on your lower back muscles.

Warning **To prevent injury and equipment damage, never attempt to lift or tilt the router chassis using the handles on the fan tray or on line cards. These handles do not support the weight of the chassis.**

Site Requirement Guidelines

These sections contain the site requirement guidelines that you should be familiar with before installing the router:

- Site Wiring Guidelines, page 1-7
- Rack-Mounting and Air Flow Clearance Guidelines, page 1-8
- Chassis Air Flow Guidelines, page 1-7
- Temperature and Humidity Guidelines, page 1-12
- Power Connection Guidelines, page 1-12
- NEBS Supplemental Unit Bonding and Grounding Guidelines, page 1-20

Site Layout and Equipment Dimensions

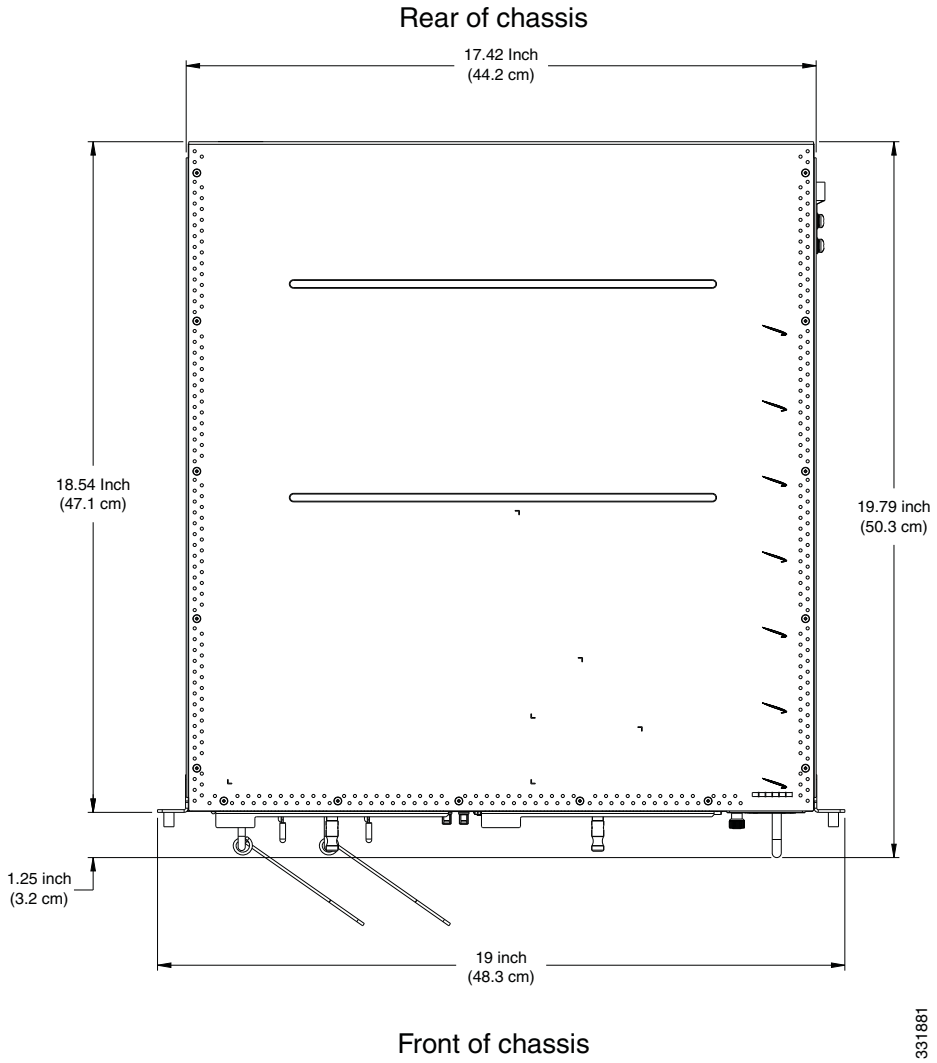
To help maintain trouble-free operation, adhere to these precautions and guidelines when planning your rack installation:

- Install the system in a restrictive access location with means for a permanent grounding.
- Ensure the site of the rack includes provisions for source AC or DC power, grounding, and network interface cables.
- Allow sufficient space to work around the rack during the installation. You need at least 3 feet (91.44 cm) adjacent to the rack to move, align, and insert the chassis.
- Maintain at least 24 inches (61 cm) of clearance in front of, and behind the chassis for maintenance after installation.
- To mount the router between two posts or rails, the usable aperture (the width between the inner edges of the two mounting flanges) must be at least 17.75 inches (45.09 cm) for the Cisco ASR 9001 Router.
- Height of the Cisco ASR 9001 Router is 3.47 inches (8.8 cm).
- When fully populated with cards, the router can weigh as much as 37.91 pounds (17.2 kg). To maintain equipment rack stability and to ensure your safety, the rack is provided with stabilizing devices. Make sure you install the stabilizers before installing the router.
- If you use a telco-style rack, the weight of the chassis is cantilevered off the two rack posts. Make sure that:
  - Weight of the router does not make the frame unstable.

  - Frame is bolted to the floor and is secured to the building structure using either wall brackets or overhead brackets.
- When mounting the router in a telco-style rack or 4-post rack, be sure to use all the screws provided to secure the chassis to the rack posts.
- Install the cable-management brackets included with the router to keep cables organized. Be sure to use appropriate strain-relief methods to protect cables and equipment connections.
- To avoid noise interference in network interface cables, do not route them directly across or along power cables.

Figure 1-4 shows the top-down view chassis dimensions of the Cisco ASR 9001 Router.

Figure 1-4 Cisco ASR 9001 Router Chassis Footprint and Dimensions—Top View



Site Wiring Guidelines

When planning the location of the router, consider distance limitations for signaling, electromagnetic interference (EMI), and connector compatibility. If the wiring is run for any significant distance in an electromagnetic field, interference can occur between the field and the signals on the wires. Poor wiring can cause:

- Radio interference emanating from the wires.
- Strong EMI, especially when caused by lightning or radio transmitters. EMI can destroy the signal drivers and receivers in the router, and can even create an electrical hazard by conducting power surges through lines and into equipment.

Note To predict and remedy strong EMI, you may need to consult with radio frequency interference (RFI) experts.

Site wiring is unlikely to emit radio interference if you use twisted-pair cable with good distribution of grounding conductors. Use a high-quality twisted-pair cable with one ground conductor for each data signal, when applicable.

Give special consideration to the effect of lightning strikes in your vicinity, especially if the wiring exceeds recommended distances, or if it passes between buildings. The electromagnetic pulse (EMP) caused by lightning or other high-energy phenomena can easily induce enough energy into unshielded conductors, and destroy electronic devices. If you have experienced EMP problems in the past, you may want to consult experts in electrical surge suppression and shielding.

Most data centers cannot resolve infrequent, but potentially catastrophic, problems without pulse meters and other special equipment. In addition, these problems can take a great deal of time to identify and resolve. We recommend that you take the necessary precautions to avoid these problems by providing a properly grounded and shielded environment, with special attention to issues of electrical surge suppression.

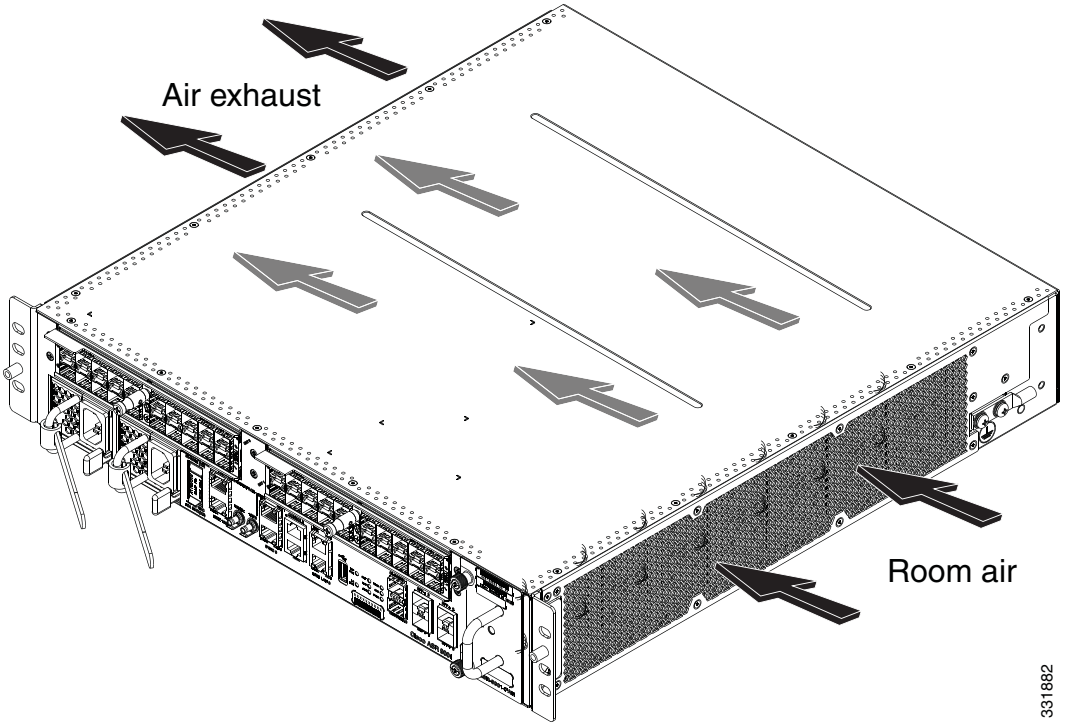
Chassis Air Flow Guidelines

Cool air is circulated through the Cisco ASR 9001 Router by one fan tray located along the right side of the router (see Figure 1-5).

The fan tray maintains acceptable operating temperatures for the internal components by drawing in cool air through the vents, and circulating the air through the chassis. Each power supply is also equipped with fans that draw cool air into the front of the power supply and force warm air out of the air exhaust.

Note See the "Rack-Mounting and Air Flow Clearance Guidelines" section on page 1-8 section for details on air flow clearance requirements for installation in an enclosed 4-post rack.

Figure 1-5 Air Flow Path through the Cisco ASR 9001 Router



When selecting a site to install the router, observe these guidelines:

- Dust free area—Site should be as dust free as possible. Dusty environments can clog the power supply intake vents, reducing the cooling air flow through the router. Clogged filters and vents can cause an over-temperature condition in the router.
- Unrestricted air flow—Allow sufficient air flow by maintaining a minimum of 6 inches (15.24 cm) of clearance at both the inlet and exhaust openings on the chassis and the power modules. If the air flow is blocked or restricted, or if the inlet air is too warm, an over-temperature condition can occur within the router. Under extreme conditions, the environmental monitoring system powers off the router to protect the components.

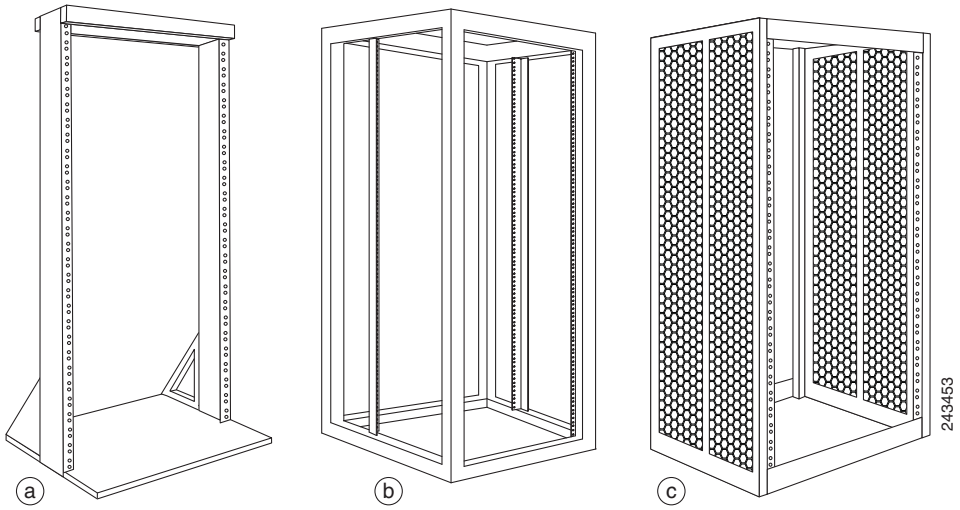
See "Rack-Mounting and Air Flow Clearance Guidelines" for details on air flow clearance requirements for installation in an enclosed 4-post rack.

Rack-Mounting and Air Flow Clearance Guidelines

The router can be mounted in most 2-post, 4-post, or telco-style 19-inch equipment racks that comply with the Electronics Industries Association (EIA) standard for equipment racks (EIA-310-D). The rack must have at least two posts with mounting flanges to mount the router chassis. The distance between the center lines of the mounting holes on the two mounting posts must be 18.31 inches ± 0.06 inch (46.50 cm ± 0.15 cm).

Figure 1-6 shows examples of typical 2-post, 4-post, and telco-type equipment racks.

Figure 1-6 Equipment Rack Types



a	Telco-style rack	**b**	Free-standing, 4-post open rack with two mounting posts in the front, two mounting posts in the back or along each side	**c**	Free-standing enclosed rack with perforated sides and two mounting posts in the front

Telco 2-Post Rack

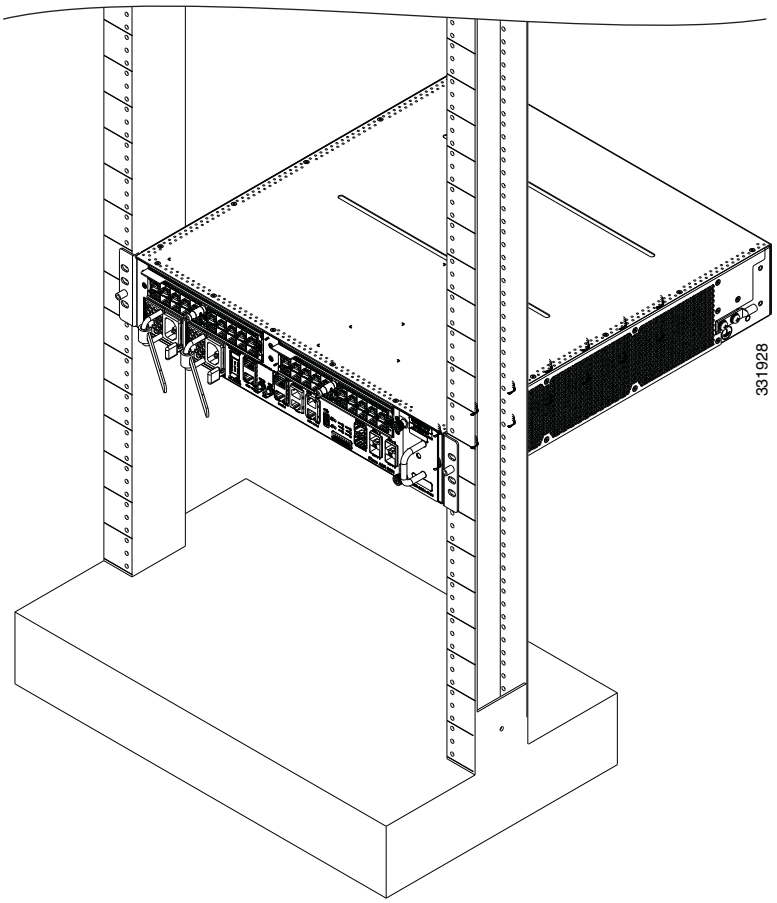
Item a in Figure 1-6 shows a telco-style rack. The *telco-style rack* is an open frame consisting of two posts tied together by a cross-bar at the top and a floor-stand at the bottom.

This type of rack is usually secured to the floor, and sometimes to an overhead structure or wall for additional stability. The router chassis can be installed in the telco-style rack only in a front-mounted position.

In the front-mounted position, you secure the chassis rack-mounting brackets directly to the rack posts (see Figure 1-7 as an example of a Cisco ASR 9001 Router rack mounting). Two rear mounting brackets are provided for mounting the Cisco ASR 9001 Router in a 2-post rack.

Note The mounting brackets on the Cisco ASR 9001 Router chassis have a pair of holes at the top and bottom of each bracket; the remaining openings in the brackets are slots. If the Cisco ASR 9001 Router is to be mounted in a 2-post 19-inch rack, you must first use the holes to locate and position the brackets on the rack. Insert screws through the bracket holes into the rack before inserting screws through the bracket slots.

Figure 1-7 Cisco ASR 9001 Router Mounted in a 2-Post Rack



Open 4-Post Rack

Item b in Figure 1-6 shows a free-standing, 4-post open rack with two mounting posts in the front and two mounting posts in the back or along the side. The mounting posts in this type of rack are often adjustable so that you can position the rack-mounted unit within the depth of the rack rather than flush-mount it with the front of the rack.

Two rear mounting brackets are provided for mounting the Cisco ASR 9001 Router in a 4-post rack.

Enclosed Rack with Perforated Sides

Item c in Figure 1-6 shows a free-standing 4-post enclosed rack with perforated sides and two mounting posts in the front.

Caution Do not install the Cisco ASR 9001 Router in any type of fully-enclosed rack that does not have the required perforated sides or doors; the router requires an unobstructed flow of cooling air to maintain acceptable operating temperatures for its internal components. Installing the router in any type of fully-enclosed rack without proper perforation could disrupt the air flow, trap heat next to the chassis, and cause an over-temperature condition inside the router.

Air Flow Guidelines for Enclosed Rack Installation

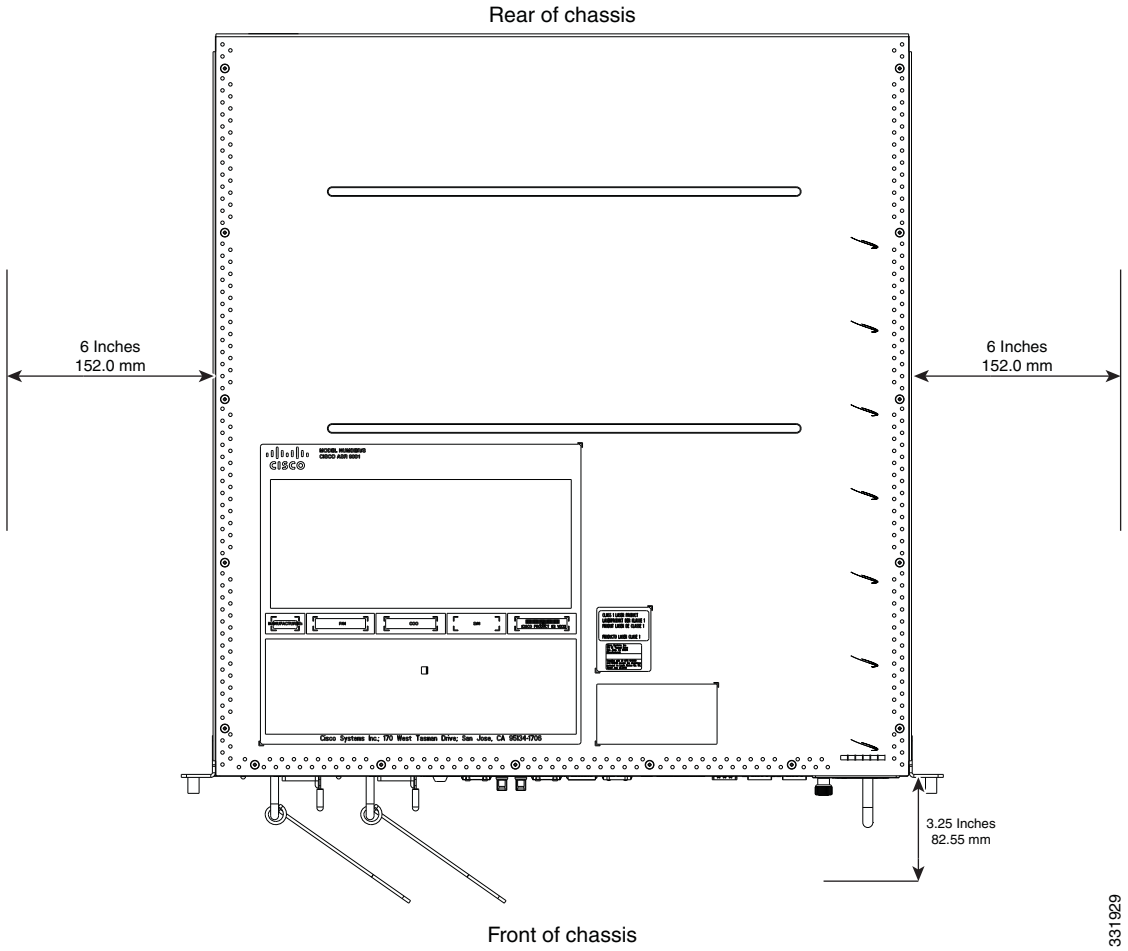
To install a Cisco ASR 9001 Router in a 4-post enclosed cabinet, the front and rear doors of the cabinet must be removed or be perforated with a minimum of 65% open area (70% for ETSI 800mm racks).

If you are mounting the chassis in a 4-post enclosed cabinet, ensure that you have these clearances aound the chassis:

- Rear: Minimum of 3.15 inches (8.00 cm) of clearance
- Sides: Minimum of 6 inches (15.24 cm) of clearance on each side of the chassis.

Figure 1-8 shows the side and rear chassis air flow clearance requirements for mounting the Cisco ASR 9001 Router in a 4-post enclosed rack.

Figure 1-8 ASR 9001 Clearance Requirements for an Enclosed 4-Post Rack Installation



Temperature and Humidity Guidelines

The operating and nonoperating environmental site requirements are listed in Table A-2. The router normally operates within the ranges listed in Table A-3; however, if a temperature measurement is approaching a minimum or maximum parameter, it indicates a potential problem. Maintain normal operation by anticipating and correcting environmental anomalies before they approach critical values, by properly planning and preparing your site before you install the router.

Power Connection Guidelines

You can configure the router with either an AC-input or DC-input power subsystem, so the site power source requirements differ depending on the power subsystem in your router. Ensure all power connection wiring conforms to the rules and regulations in the National Electrical Code (NEC) as well as local codes.

Caution Each Cisco ASR 9001 Router is powered by only one type of input: AC or DC. A hybrid (AC+DC) power configuration is not supported.

Caution Proper grounding is necessary to avoid damage from lightning and power surges. See the "NEBS Supplemental Unit Bonding and Grounding Guidelines" section on page 1-20 for grounding requirements.

AC Powered Routers

AC power modules operate in the input range of 100 VAC to 240 VAC, 50 to 60 Hz and require a minimum service of:

- 15 A for operation in North America and Japan
- 10 A for international operation
- 13 A for operation in the UK

Each of the AC power inputs requires a separate dedicated branch circuit. For a list of the nominal and acceptable value ranges for source AC power, see Table A-5.

Table 1-1 lists the AC-input power cord options, specifications, and Cisco product numbers for the AC-input power supply modules. Table 1-1 also references power cord illustrations. For more information on Cisco product numbers (PIDs) and their detailed description of power cords, refer to Dynamic Configuration Tool.

Table 1-1 AC-Input Power Cord Options for ASR 9001 Router

Locale	Part Number	Length	Power Cord Rating	Reference Illustration
USA	CAB-AC	8.2 feet (2.5 m)	15 A, 250 V	Figure 1-9
Japan	CAB-L620P-C13-JPN	8.2 feet (2.5 m)	15 A, 250 V	Figure 1-10
Australia	CAB-ACA	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-11
Italy	CAB-ACI	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-12
Argentina	CAB-ACR	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-13
Switzerland	CAB-ACS	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-14
UK	CAB-ACU	8.2 feet (2.5 m)	13 A, 250 V	Figure 1-15
China	CAB-ACC	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-16
South Africa/India	CAB-ACSA	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-17
Europe	CAB-9K10A-EU	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-18
Israel	SFS-250V-10A-IS	8.2 feet (2.5 m)	10 A, 250 V	Figure 1-19

AC Power Cord Illustrations

This section contains the AC power cord illustrations, as described in Table 1-1. Note that an AC power cord may be used with several power supplies.

Figure 1-9 AC Power Cord CAB-AC

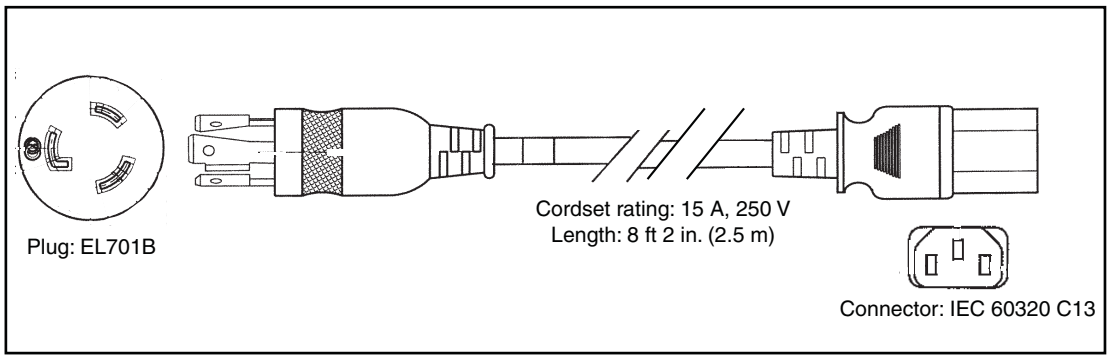


Figure 1-10 AC Power Cord CAB-L620P-C13-JPN

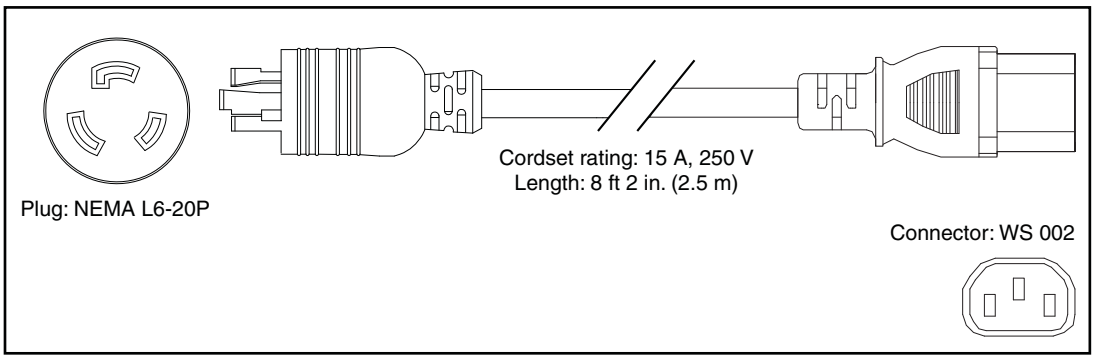


Figure 1-11 AC Power Cord CAB-ACA

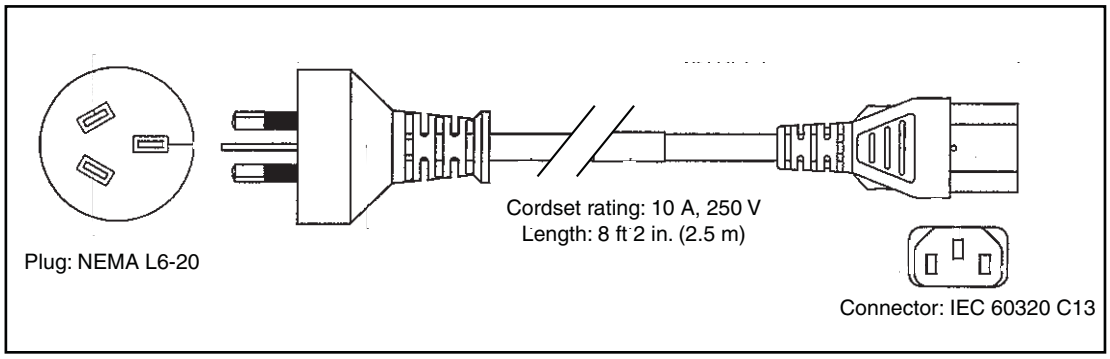


Figure 1-12 AC Power Cord CAB-ACI

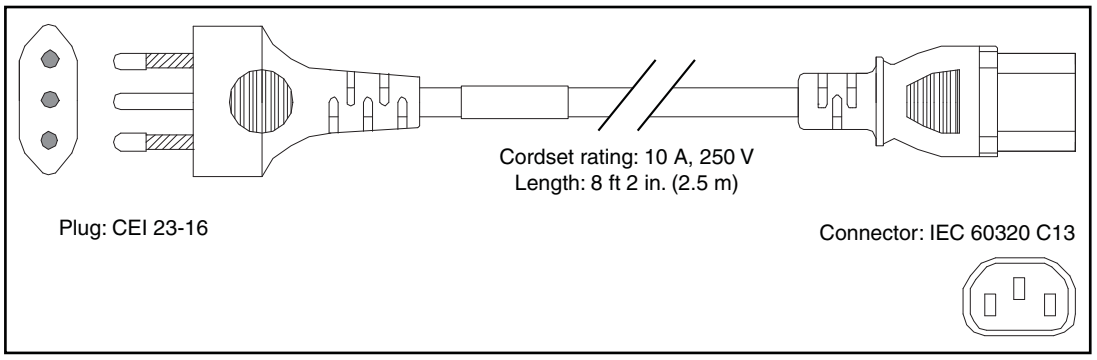


Figure 1-13 AC Power Cord CAB-ACR

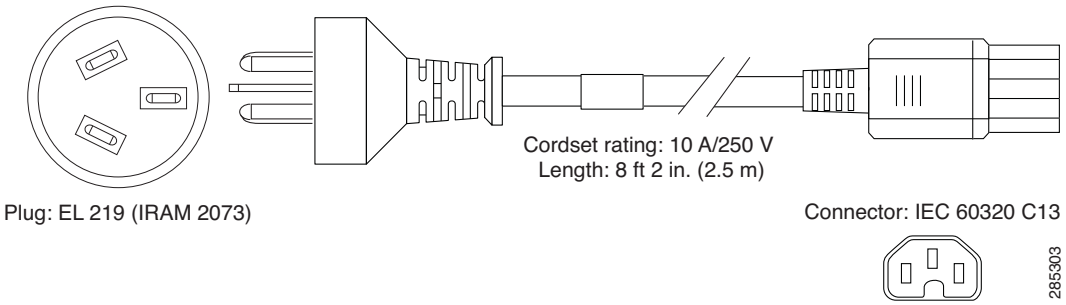


Figure 1-14 AC Power Cord CAB-ACS

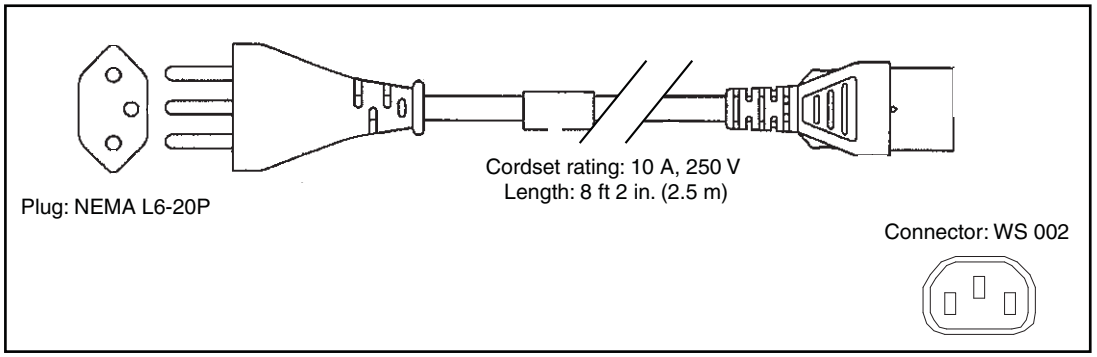


Figure 1-15 AC Power Cord CAB-ACU

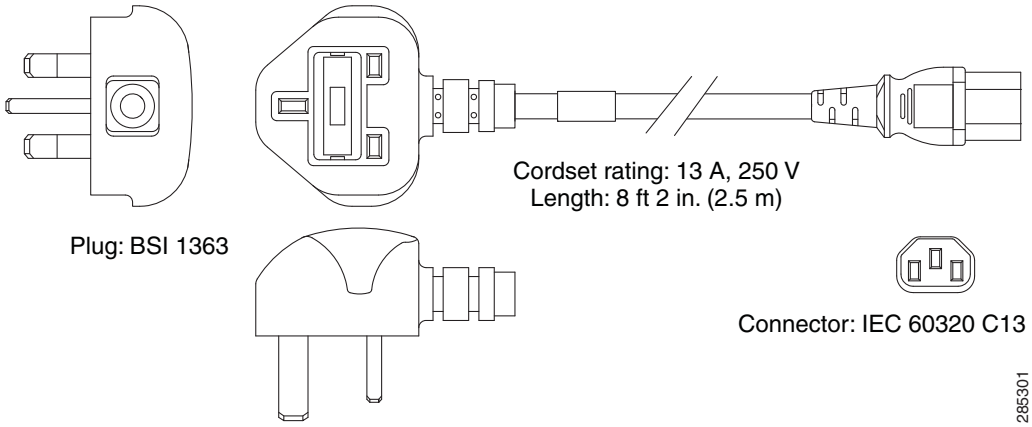


Figure 1-16 AC Power Cord CAB-ACC

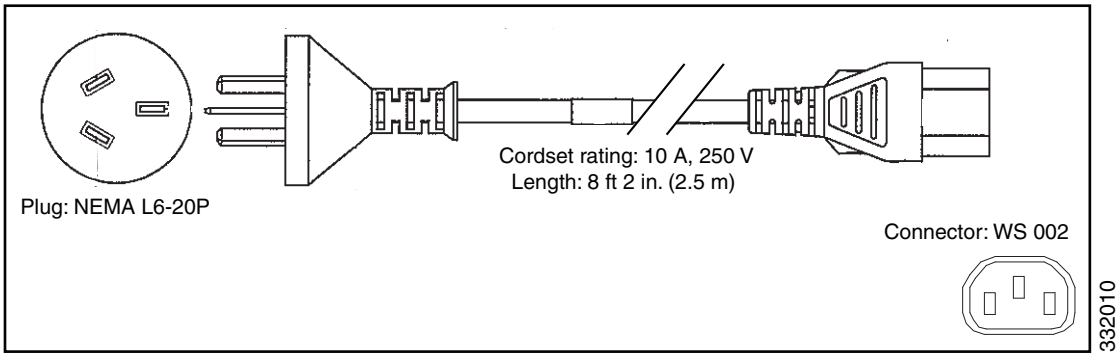


Figure 1-17 AC Power Cord CAB-ACSA

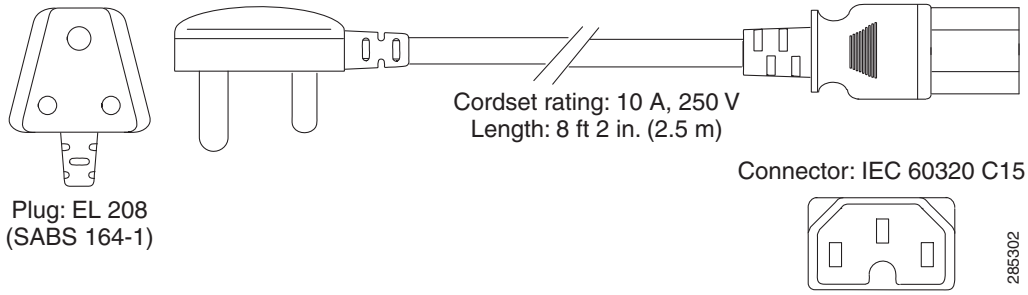


Figure 1-18 AC Power Cord CAB-9K10A-EU

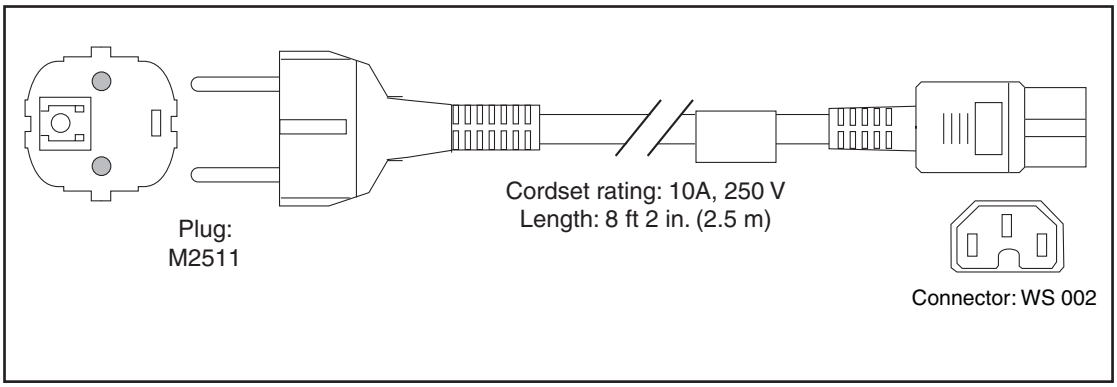
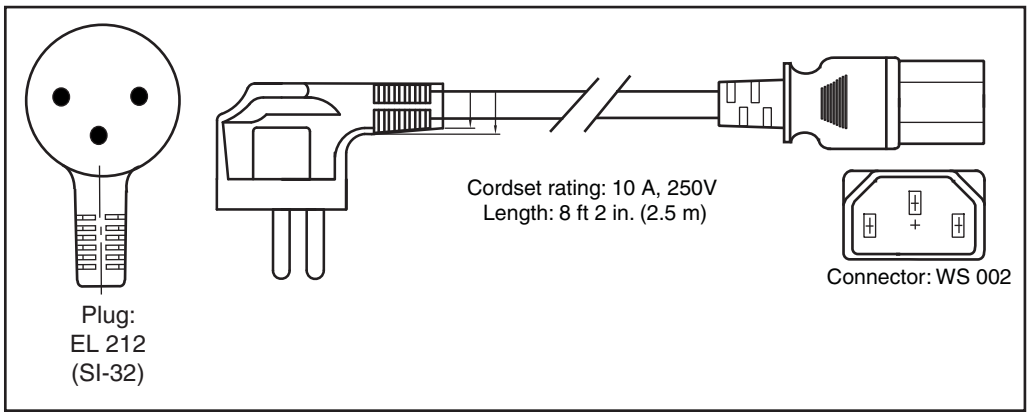


Figure 1-19 AC Power Cord SFS-250V-10A-IS



DC Powered Router

Connections to DC power modules are rated at 20 A maximum. The system accepts a nominal input voltage of –48 VDC with an operational tolerance range of –48 VDC to –60 VDC. One dedicated, commensurately rated DC power source is required for each power module connection.

Power connections to the each DC power module requires two cables: one source cable and one return cable.

For DC power cables, we recommend that you use 20-A-rated, high-strand-count copper wire cables.

The length of the cables depends on your router location from the source power.

Note DC power cables are not available from Cisco, but they are available from external commercial cable vendors.

You must terminate DC power cables using terminal blocks. The terminal blocks are supplied along with the DC power supply modules from Cisco. The terminal block part number is PC 5/2-STF-7.62 BD:+,- from Phoenix contact.

Figure 1-20 shows the type of terminal block required for DC-input cable connections.

Figure 1-20 DC Power Cable Terminal Block

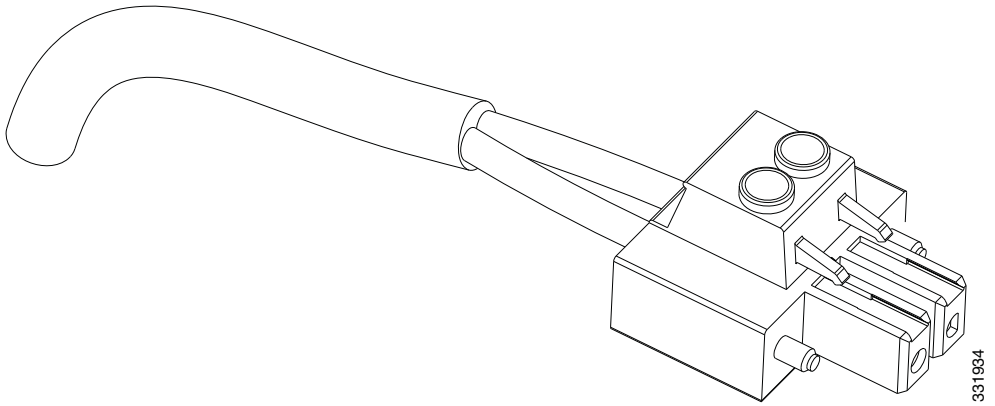


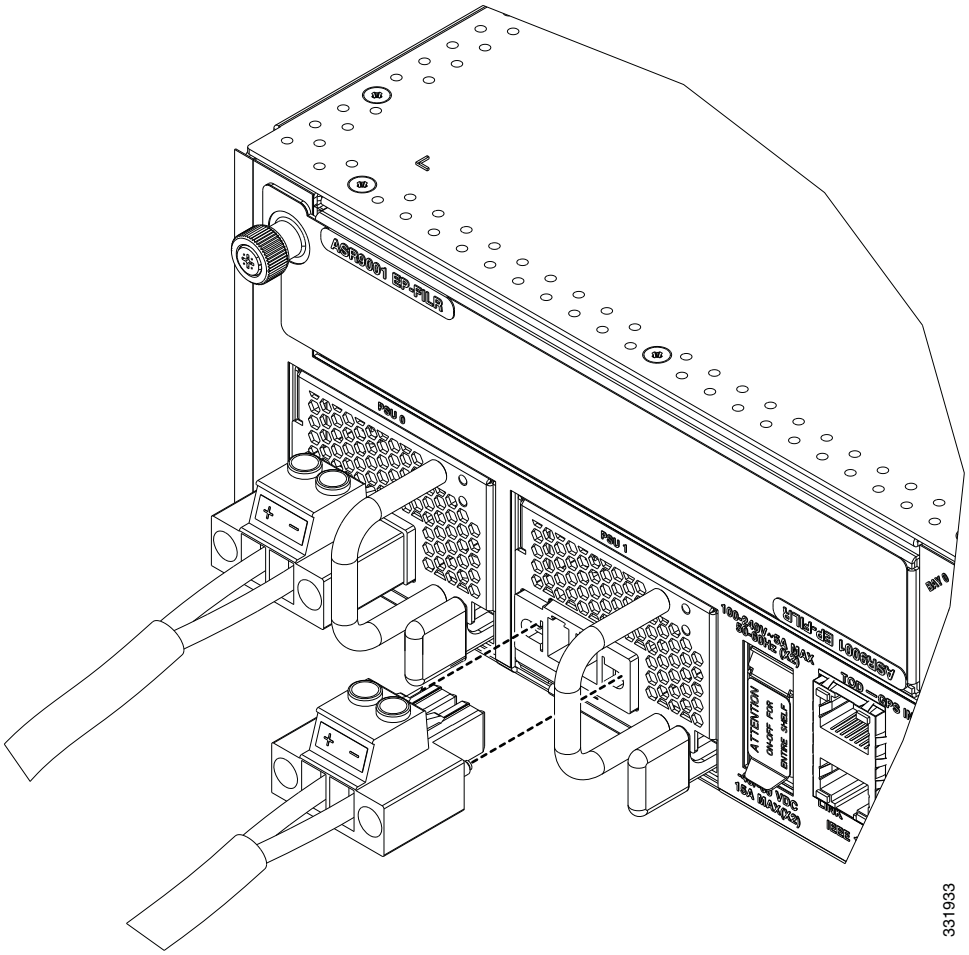
Figure 1-21 shows DC power source cable connections for single DC power module.

Warning **To avoid shock hazard, be sure to apply shrink wrap tubing around the wire entry area of the terminal block.**

Warning **Hazardous voltage or energy may be present on power terminals. Always replace cover when terminals are not in service. Be sure uninsulated conductors are not accessible when cover is in place.** Statement 1086

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.** Statement 1030

Figure 1-21 DC Power Source Cabling Scheme for a Single DC Power Module



The color coding of the source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, be sure that power source cables are connected to the power modules using the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, but you must also verify the polarity by measuring the voltage between the DC cable leads. Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the power module when making the measurement.
- Green (or green and yellow) cable typically indicates that it is a ground cable.

Caution DC power modules contain reverse voltage protection circuitry to prevent damage to the power module if it detects a reverse polarity condition. No damage should occur from reverse polarity, but you should correct a reverse polarity condition immediately.

For a list of the nominal and acceptable value ranges for source DC power, see Table A-4 on page A-3.

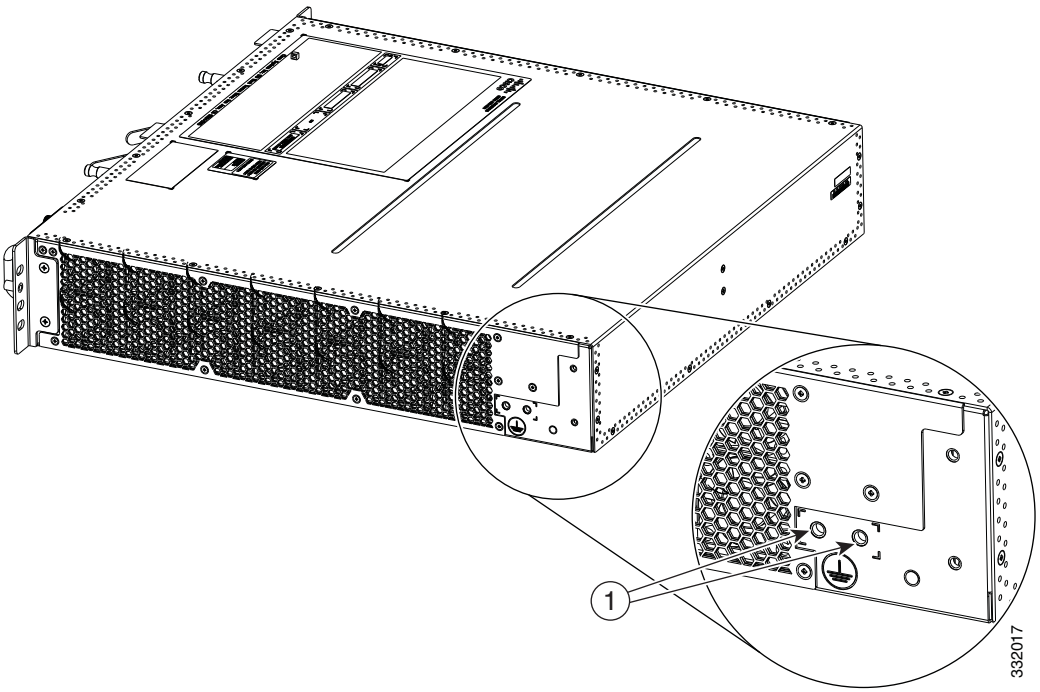
NEBS Supplemental Unit Bonding and Grounding Guidelines

Although the router chassis requires a safety earth ground connection as part of the power cabling to power modules, you must permanently connect the central office ground system or interior equipment grounding system to the supplemental bonding and grounding connection on the side of the router chassis to meet network equipment building system (NEBS) requirements as well as safety compliance requirements. These grounding points are referred to as the NEBS bonding and grounding points.

Figure 1-22 shows the NEBS grounding locations for the Cisco ASR 9001 Router.

Note These bonding and grounding connections satisfy the Telcordia NEBS requirements for supplemental bonding and grounding connections. If you are not installing the router in a NEBS environment, you can choose to bypass these guidelines and rely on the safety earth ground connections to the AC or DC power modules.

Figure 1-22 NEBS Bonding and Grounding Points on the Cisco ASR 9001 Router



1	NEBS grounding point on side of chassis

To ensure a satisfactory supplemental ground connection to the router, use these parts:

- One grounding lug, which has two M6 bolt holes with 0.625- to 0.75-inch (15.86- to 19.05-mm) spacing between them, and a wire receptacle large enough to accept a six AWG or larger, multistrand copper wire. For four AWG cable, use Panduit part number LCD4-14AF-L; for six AWG, use Panduit part number LCD6-14AF-L.
- Two 10-32 round-head screws and two locking washers (nickel-plated brass is ideal).

- One grounding wire. Although we recommend at least six AWG multistrand copper wire, the wire diameter and length depend on your router location and site environment.

Note These parts are not available from Cisco, but they are available from external commercial vendors.

Cisco ASR 9001 Router Port Connection Guidelines

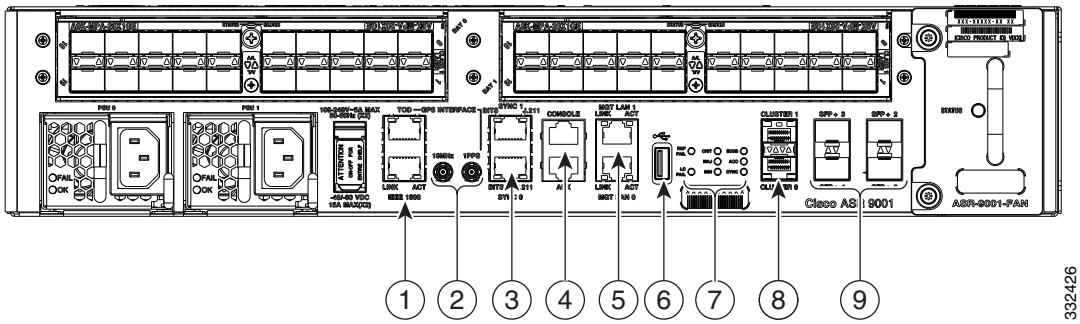
This section contains detailed cabling and signal information for all interface and port connections to the RP. It also provides information for Ethernet routing and equipment.

Caution Ports labeled Ethernet, SYNC, CONSOLE, and AUX are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits.

Note In Cisco ASR 9001-S Router, two 10 GE fixed SFP+ ports (SFP+2 and SFP+3) are disabled by default, and can be enabled by a license upgrade.

Figure 1-23 shows all the port connections on the front panel of the Cisco ASR 9001 Router.

Figure 1-23 Cisco ASR 9001 Router Front Panel Ports



1	Service LAN and ToD ports	**6**	External USB port
2	10MHz and 1PPS indicators	**7**	Eight discrete LED indicators
3	SYNC (BITS/J.211) ports	**8**	CLUSTER ports
4	CONSOLE and AUX ports	**9**	Fixed SFP+ ports
5	Management LAN ports		

Table 1-2 lists the Cisco ASR 9001 Router front panel ports description.

Table 1-2 Cisco ASR 9001 Router Front Panel Ports Description

Port Name	Connector Type	Description
TOD Port	RJ45	Time of Day Input/Output Port along with 1PPS Signal. Signal type is RS422.
Service LAN Port (IEEE 1588)	RJ45	A 10/100Mbps Ethernet Port for IEEE1588 Grand Master Connection through CAT5 cable. Signal type is MLT3.
10MHz Connector	SMB	10MHz Input for GPS Synchronization. This signal can provide 10MHz output as well from Cisco ASR 9001 Router. Signal type is sinusoidal.
1PPS Connector	SMB	1PPS Input for GPS Synchronization. This signal can provide output as well from Cisco ASR 9001 Router. Signal type is square wave.
SYNC Ports (SYNC 0/SYNC 1)	RJ45	Used as BITS or DTI (one at a time) Input/Output Port based on the configuration used. CAT5 ethernet cable can be used for DTI. In DTI mode link resembles an Ethernet (802.3) 10BaseT link. Signal type depends on the mode such as B8ZS for T1, HDB3 for E1, Manchester Coded Data for DTI, Sinusoidal for 6.3128 Out.
CONSOLE Port	RJ45	Local Craft Terminal for connecting the box with PC. Used to command the CPU and to collect CPU log. This console port operates at default 115200 baud rate however other standard baud rates can be configured through confreg setting at Rommon. Signal type is RS232.
AUX Port	RJ45	Local Craft Terminal with modem handshaking signals. This port operates at default 115200 baud rate however other standard baud rates can be configured through confreg setting at Rommon. The hardware has design option (through IMIO FPGA) to connect the AUX port with RP CPU or LC CPU. This can be used as console port for the LC CPU. Signal type is RS232.
Management LAN Ports (MGT LAN 0/1)	RJ45	Management Port for TFTP boot. It is a tri speed (10/100/1000 Mbps) Ethernet port with auto negotiation enabled. Connection through CAT5E cable. Signal type is 8B/10B for 1G, MLT3 for 100 Mbps, Manchester coded for 10 Mbps.
USB Port	USB TYPE-A Receptacle	For connecting USB Device. This port can be used to upload installable modules, temporary binaries, scripts etc through USB disk. Also, it can be used to transfer router log from the internal eUSB to the external memory stick. Signal type is NRZI.

Table 1-2 Cisco ASR 9001 Router Front Panel Ports Description

Port Name	Connector Type	Description
CLUSTER Ports (0/1)	SFP	For Cascading two Cisco ASR 9001 Router systems. The pinout and signal level is as per the SFP standard. This supports copper/optical SFP modules.
Fixed SFP+ Ports (0/1/2/3)	SFP+	Fixed ports include 4X10G SFP+ ports and supports 20X1G, 4X10G and 2X10G ports through Ethernet Plugs.

Console Port and Auxiliary Port Connection Guidelines

The RP has two EIA/TIA-232 (formerly RS232) serial RJ-45 connection ports (see Figure 1-23):

- Console port—RJ-45 interface for connecting a data terminal device to the router, which you need to perform the initial configuration of the router.
- Auxiliary port—RJ-45 interface for connecting a modem.

Note The console and auxiliary ports are asynchronous serial ports. Ensure that devices connected to these ports are capable of asynchronous transmission.

Console Port Signals

The *RP console port* is an RJ-45 interface for connecting a terminal to the router. The console port does not support modem control or hardware flow control and requires a straight-through RJ-45 cable.

Before connecting a terminal to the console port, check the terminal setting for the data transmission rate, in bits per second (bps). The terminal transmission rate setting must match the default rate of the RP console port, which is 115200 bps. Set the terminal to these operational values: 115200 bps, 8 data bits, no parity, 1 stop bits (115200 8N1).

Table 1-3 lists the signals used on the RP console port.

Table 1-3 RP Console Port Signals

Console Port Pin	Signal	Input/Output	Description
1	RTS	Output	Request to Send
2	—	—	(Not connected)
3	TxD	Output	Transmit data
4	GND	—	Signal ground
5	GND	—	Signal ground
6	RxD	Input	Receive data
7	—	—	(Not connected)
8	CTS	Input	Clear to Send

Auxiliary Port Signals

The *RP Auxiliary (AUX) port* is a RJ-45 interface for connecting a modem or other data communication equipment (DCE) device (such as another router) to the RP. The AUX port supports hardware flow control and modem control.

Table 1-4 lists the signals used on the Auxiliary port.

Table 1-4 RP AUX Port Signals

AUX Port Pin	Signal	Input/Output	Description
1	RTS	Output	Request to send
2	DTR	Output	Data terminal ready
3	TxD	Output	Transmit data
4	GND	—	Signal ground
5	GND	—	Signal ground
6	RxD	Input	Receive data
7	DSR	Input	Data set ready
8	CTS	Input	Clear to send

Management LAN Ports Connection Guidelines

The RP has two RJ45 media-dependent interface (MDI) Ethernet management LAN ports: MGT LAN 0 and MGT LAN 1 (see Figure 1-23).

These ports are used for IEEE 802.3 10BASE-T (10 Mbps), IEEE 802.3u 100BASE-TX (100 Mbps), or 1000BASE-T (1000 Mbps) Ethernet connections.

The transmission speed of the management LAN ports is not user-configurable. The transmission speed is set through an auto-sensing scheme on the RP; the speed is determined by the network to which that the Ethernet port is connected. The combined total input rate of both MGT LAN 0 and MGT LAN 1 is about 12 Mbps.

Management port characteristics are:

- Maximum transmission unit (MTU) is fixed at 1514 and cannot be configured.
- Flow control is disabled and cannot be configured.
- Input unicast packets with an unknown destination address are filtered and dropped.
- Autonegotiation of port speed (10/100/1000) and duplex (full/half) is supported. Autonegotiation cannot be disabled.

Table 1-5 lists the signals used on the Management LAN ports.

Table 1-5 RP Management LAN Port Signals

MGT LAN Port Pin	10Base-T, 100Base-TX Signal	1000Base-T Signal
1	Transmit+	BI_DA+
2	Transmit–	BI_DA–
3	Receive+	BI_DB+

Table 1-5 RP Management LAN Port Signals (continued)

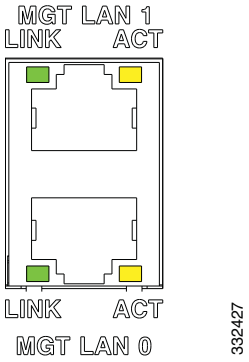
MGT LAN Port Pin	10Base-T, 100Base-TX Signal	1000Base-T Signal
4	—	BI_DC+
5	—	BI_DC–
6	Receive–	BI_DB–
7	—	BI_DD+
8	—	BI_DD–

Management LAN Port LED Indicators

The Management LAN connectors have integral LED indicators (see Figure 1-24). When lit, these LEDs indicate:

- Green (LINK)—Connection is alive.
- Amber (ACT)—Connection is active.

Figure 1-24 RP Management LAN Port LED Indicators



Management LAN RJ-45 Cabling

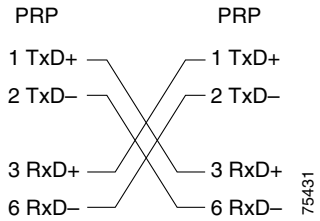
When connecting the RJ-45 port to a hub, repeater, or switch, use the straight-through cable pinout shown in Figure 1-25.

Note To comply with the intra-building lightning surge requirements of Telecordia GR-1089-CORE, Issue II, Revision 01, February 1999, you must use a shielded cable when connecting the management LAN ports on the RP card. The shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Figure 1-25 Straight-Through Cable Pinout to a Hub, Repeater or Switch

When connecting to a router, use the crossover cable pinout shown in Figure 1-26.

Figure 1-26 Crossover Cable Pinout Between RP



Sync Ports Connection Guidelines

The SYNC 0 and SYNC 1 ports are timing synchronization ports. They can be configured as Building Integrated Timing Supply (BITS) ports or J.211 ports (see Figure 1-23).

Note Both ports must be configured to be in the same mode. It is not possible to use external BITS and J.211 sources at the same time.

When configured as BITS ports, they provide connections for an external synchronization source. Such connections are for establishing precise frequency control at multiple network nodes, if required for your application. The RP card contains a synchronous equipment timing source (SETS) that can receive a frequency reference from an external BITS timing interface or from a clock signal recovered from any incoming Gigabit Ethernet or 10-Gigabit Ethernet interface. The RP SETS circuit filters the received timing signal and uses it to drive outgoing Ethernet interfaces.

The BITS input can be T1, E1 or 64K 4/. The BITS output can be T1, E1 or 6.312M 5/.

When configured as J.211 ports, they can be used as Universal Timing Interface (UTI) ports to synchronize timing across multiple routers by connecting to an external timing source.

SYNC Port LED Indicators

The SYNC port connector has integral LED indicators (see Figure 1-27). When lit, these LEDs indicate:

- in BITS mode:
  - Green — Connection is alive.
  - Amber — A fault has occurred.

- in J.211 mode:
  - Green — DTI is operating in normal mode.
  - Amber — DTI is operating in fast mode.

Figure 1-27 SYNC Port Connector

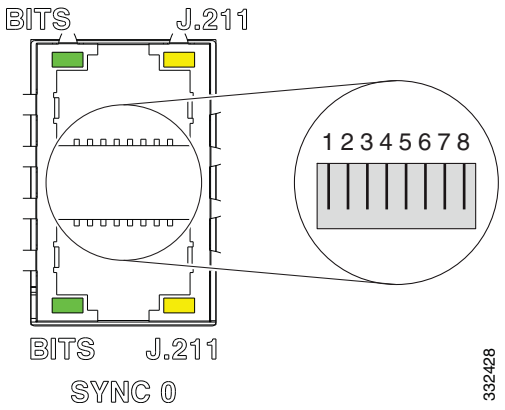


Table 1-6 BITS/J.211 Connector Pinout

Pin	Signal	Note
1	DTI_P/BITS_RX_P	Bi-direction for DTI, T1/E1/64K Input
2	DTI_P/BITS_RX_N	Bi-direction for DTI, T1/E1/64K Input
3	—	—
4	BITS_TX_P*	T1/E1/6.321M Output
5	BITS_TX_N*	T1/E1/6.321M Output
6	—	—
7	—	—
8	—	—

RP External USB Port

The Cisco ASR 9001 Router RP card has an external USB Type A slot accessible on the front panel. The front panel USB slot accepts widely available USB thumb drives. The only restriction on devices you can plug into the front panel external USB slot is that they need to be USB 2.0 devices. These devices can be formatted with FAT16, FAT32 or QNX4 file systems.

The mount point /disk1: is reserved for the front panel USB device.

Note Do not connect a USB hub device to the front panel USB port.

CHAPTER 2

Unpacking and Installing the Chassis

This chapter contains the procedures for installing the router in a rack. The installation is presented in these sections:

Pre-Installation Considerations and Requirements

Before you perform any procedures in this chapter, review these sections:

- Safety Guidelines, page 1-2
- Site Requirement Guidelines, page 1-5

In particular, observe the guidelines for preventing electrostatic discharge (ESD) damage described in the "Preventing Electrostatic Discharge Damage" section on page 1-4. Use Figure 1-3 as a reference in locating and using the ESD sockets on the front of the router chassis.

For additional safety and compliance information, see the *Regulatory Compliance and Safety Information for the Cisco ASR 9000 Series Aggregation Services Routers* document that accompanied your router.

Warning **This router is not designed to be installed as a shelf-mounted or a free-standing router. The router must be installed in a rack that is secured to the building structure. You must install the router in either a telco-style frame or a 4-post equipment rack.**

Installation Overview

A fully-equipped router with two power modules can weigh as much as 37.91 pounds (17.2 kg); an empty chassis weighs 24.69 pounds (11.2 kg). The chassis is designed to be lifted by two persons.

Required Tools and Equipment

Before you begin the rack-mount installation, you must read and understand the information in the "Rack-Mounting and Air Flow Clearance Guidelines" section on page 1-8 and have these tools and equipment:

- ESD-preventive wrist strap
- Number 1 and number 2 Phillips screwdrivers
- 1/4-inch (6.35-mm) and 3/16-inch (4.5-mm) flat-blade screwdrivers
- Tape measure
- Level (optional)
- Minimum of 10 slotted binderhead screws (usually provided with the rack) to secure the chassis to the mounting flanges (also called *rails*) in the rack. Three screws should be installed on each side of the chassis.

Unpacking the Cisco ASR 9001 Router

Follow these unpacking steps to unpack the Cisco ASR 9001 Router from its shipping container (see Figure 2-1).

Step 1 Cut the packaging tape and open the cardboard shipping container.

Step 2 Remove the accessory box.

Step 3 Remove the packaging material (see Figure 2-1).

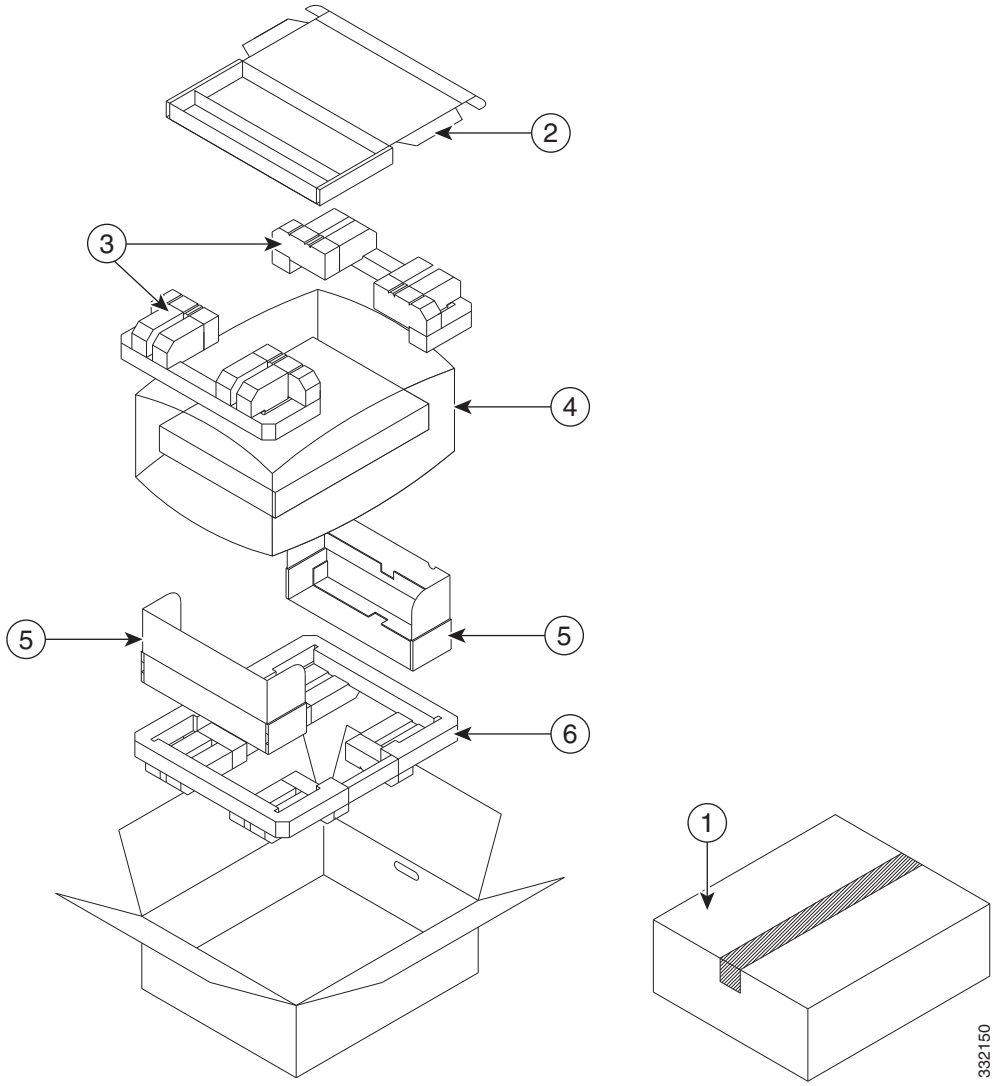
a. Remove the foam packaging material from the top of the router.

b. Remove cardboard caps from both sides.

c. Remove the router from the bag.

Step 4 Save the packaging materials in case the router needs repackaging or shipping.

Figure 2-1 Unpacking the Cisco ASR 9001 Router from the Shipping Container



1	Cardboard packaging container	**4**	Bag containing router
2	Accessory box	**5**	Cardboard caps
3	Foam packaging material- top caps	**6**	Foam packaging material - bottom cap

Positioning the Router

Use a safety hand truck to move the router to the location where it is being installed in a rack.

Rack-Mounting the Router Chassis

The router chassis is installed in a front-mounted position, as shown in Figure 1-7 for the Cisco ASR 9001 Router chassis.

In a front-mounted position, the chassis rack-mounting flanges are secured directly to the rack posts.

The PID of the rack mounting kit for Cisco ASR 9001 Router and Cisco ASR 9001-S Router is ASR-9001-2P-KIT=.

Verifying Rack Dimensions

Before you install the chassis, measure the space between the vertical mounting flanges (rails) on your equipment rack to verify that the rack conforms to the measurements shown in Figure 2-2.

Step 1 Mark and measure the distance between two holes on the left and right mounting rails.

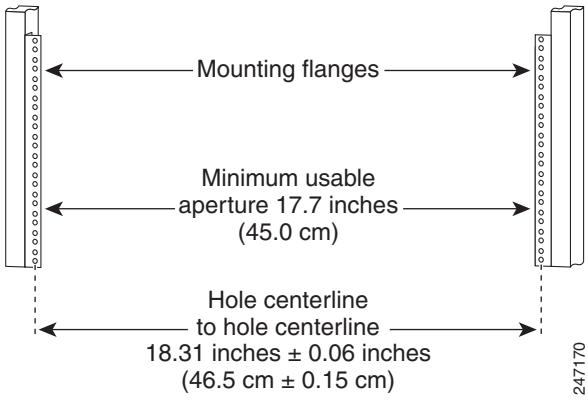
The distance should measure 18.31 inches ± 0.06 inches (46.5 cm ± 0.15 cm).

Note Measure the distance for pairs of holes near the bottom, middle and top of the equipment rack to ensure that the rack posts are parallel.

Step 2 Measure the space between the inner edges of the left front and right front mounting flanges on the equipment rack.

The space must be at least 17.7 inches (45 cm) to accommodate the chassis, which is approximately 17.45 in. (44.32 cm) wide, and fits between the mounting posts on the rack.

Figure 2-2 Verifying Equipment Rack Dimensions



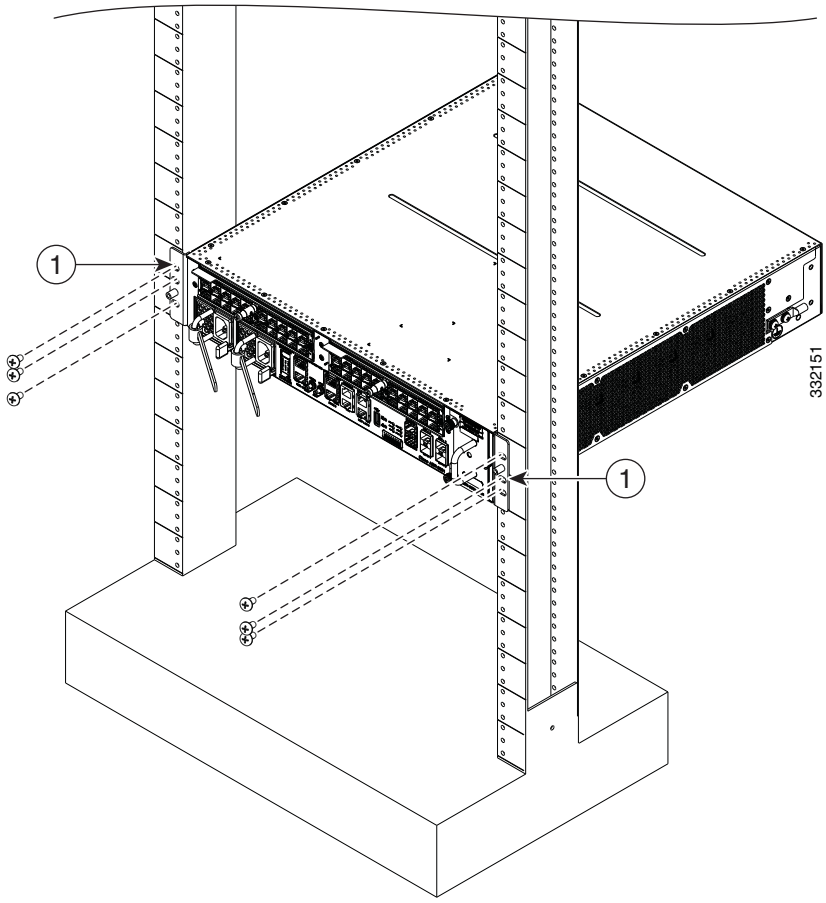
Installing the Chassis in a 2-Post Rack

Two people must lift the router chassis using the handles on the sides. To accommodate racks with different hole patterns in their mounting flanges, the chassis rack-mounting flanges have three oblong screw holes on each side.

This section describes how to install the chassis in a 2-post telco-style rack.

Figure 2-3 shows the orientation of the Cisco ASR 9001 Router chassis to the rack posts and components used in the installation.

Figure 2-3 Installing the Cisco ASR 9001 Router Chassis in a 2-Post Rack

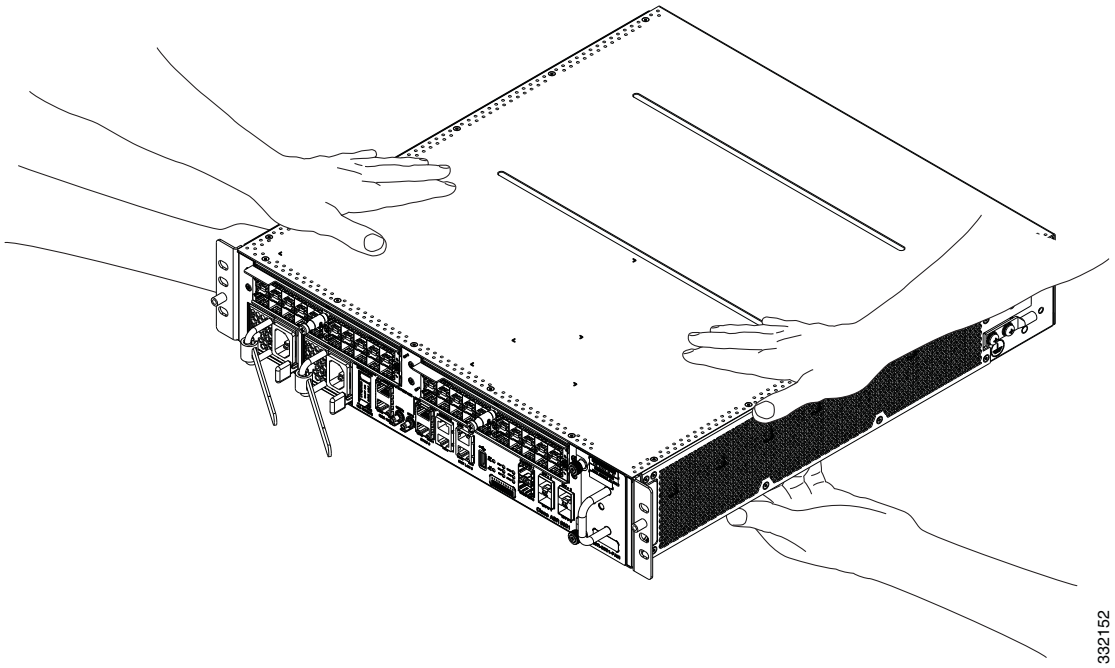


1	Three screws on each side (minimum two) to attach the router chassis to the rack

Use this procedure to install the chassis in the equipment rack:

Step 1 With two people's aid, lift the chassis into the rack holding top and bottom of the chassis (see Figure 2-4).

Figure 2-4 Correct Lifting Positions



Caution Do not grasp air inlet or exhaust when lifting the router chassis.

Step 2 Position the chassis until the rack-mounting flanges are flush against the mounting rails on the rack.

Step 3 Hold the chassis in position against the mounting rails while the second person finger-tightens a screw to the rack rails on each side of the chassis.

Step 4 Finger-tighten two more screws to the rack rails on each side of the chassis. Space the screws evenly between the top and bottom of the chassis.

Step 5 Attach the side brackets to the left and right side of the chassis by finger-tightening two screws through each bracket into the chassis.

Step 6 Attach the side bracket front flanges to the rack by finger-tightening two screws through each bracket flange into the front mounting rails of the rack.

Step 7 Fully tighten both the screws on the chassis mounting flanges on each side to secure the chassis to the rack rails.

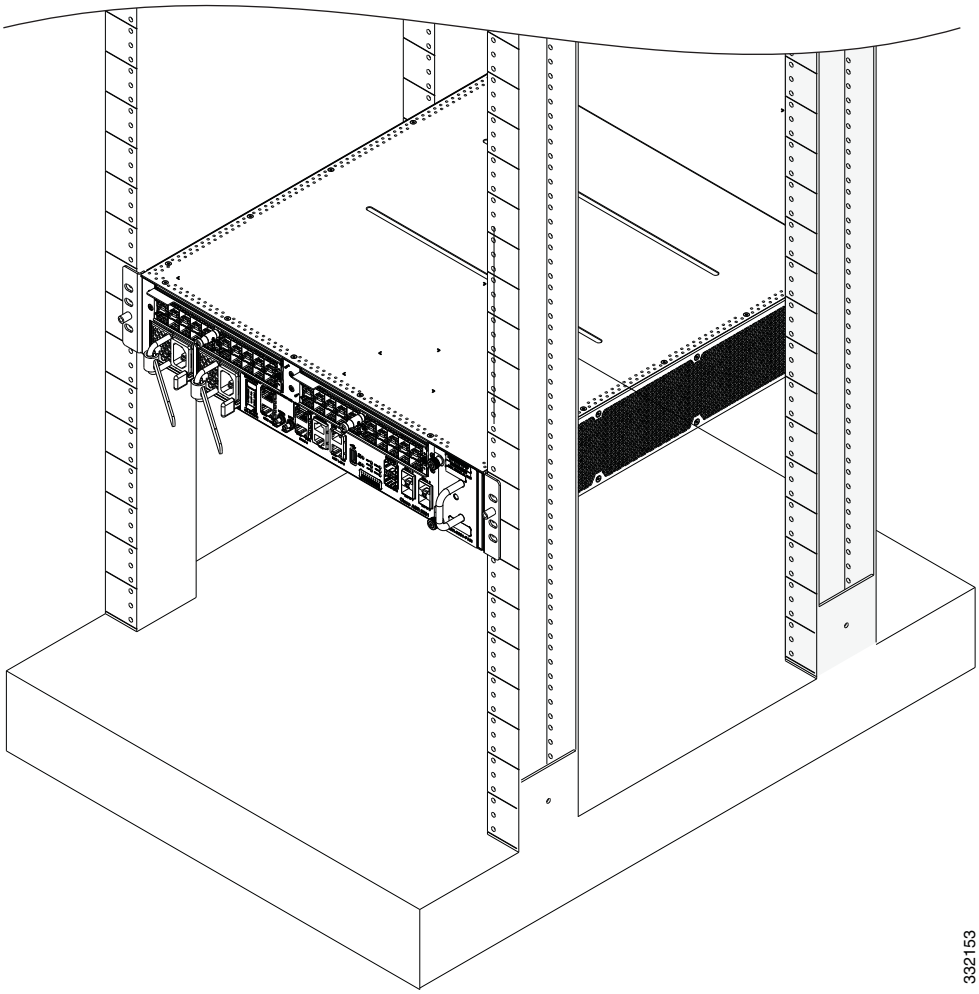
Step 8 Fully tighten the two screws on each side bracket to secure the brackets to the chassis.

Step 9 Fully tighten the two screws on each side bracket flange to secure the brackets to the rack rails.

Installing the Chassis in a 4-post Rack

To mount the Cisco ASR 9001 Router chassis in a 4-post open rack, two side brackets must be attached to the chassis and the rear posts (see Figure 2-5).

Figure 2-5 Installing the Cisco ASR 9001 Router Chassis in a 4-Post Rack



Supplemental Bonding and Grounding Connections

Before you power on the router for the first time, we recommend that you connect the central office ground system or Network Equipment Building System (NEBS) to the threaded supplemental bonding and grounding receptacles on the router. For more information on supplemental bonding and grounding cable requirements, see the "NEBS Supplemental Unit Bonding and Grounding Guidelines" section on page 1-20.

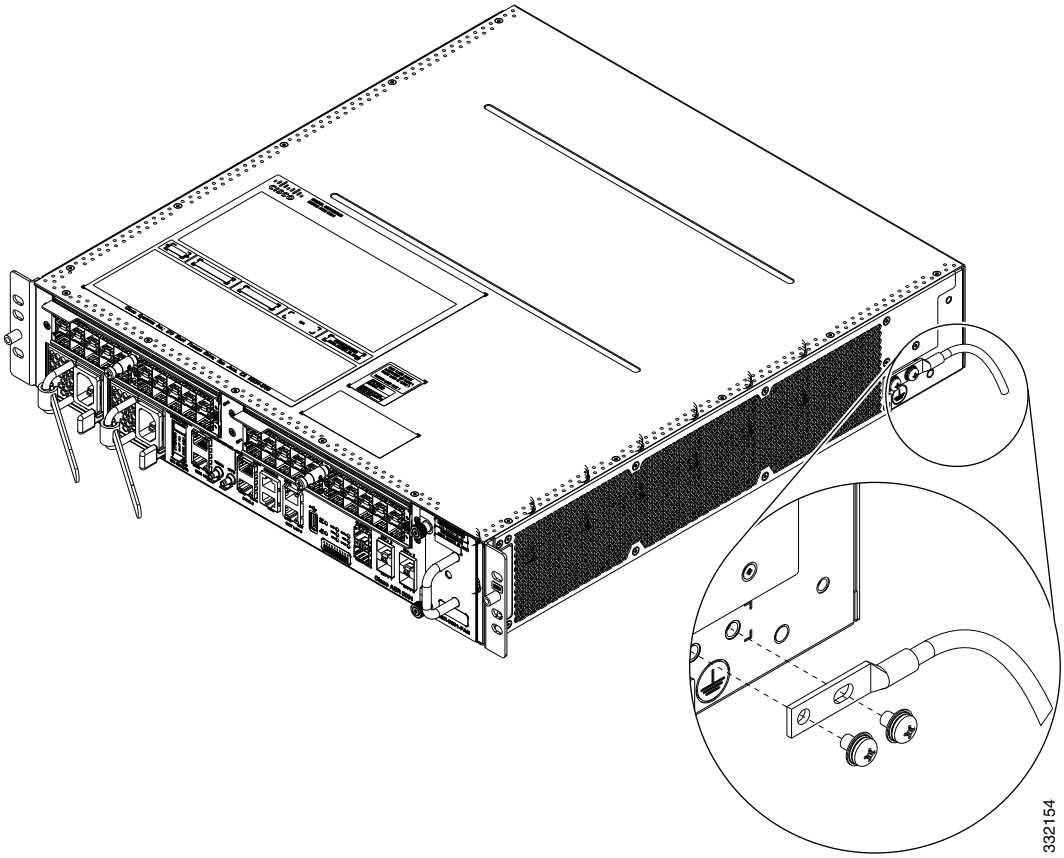
Use this procedure to attach a grounding cable lug to the router:

Step 1 Insert the grounding screws through the locking washers, and into the threaded grounding receptacle on the Cisco ASR 9001 Router chassis as shown in Figure 2-6.

Step 2 Tighten the grounding screws securely to the receptacles.

Step 3 Prepare the other end of the grounding wire, and connect it to the appropriate grounding point at your site to ensure an adequate earth ground.

Figure 2-6 NEBS Bonding and Grounding for the Cisco ASR 9001 Router



CHAPTER 3

Installing Modules and Cables in the Chassis

This chapter contains the procedures for installing cards and modules into the chassis, after it has been installed in a rack. It also describes how to connect cables to the ports and RP.

The installation is presented in these sections:

Fixed 4x10-Gigabit Ethernet Ports

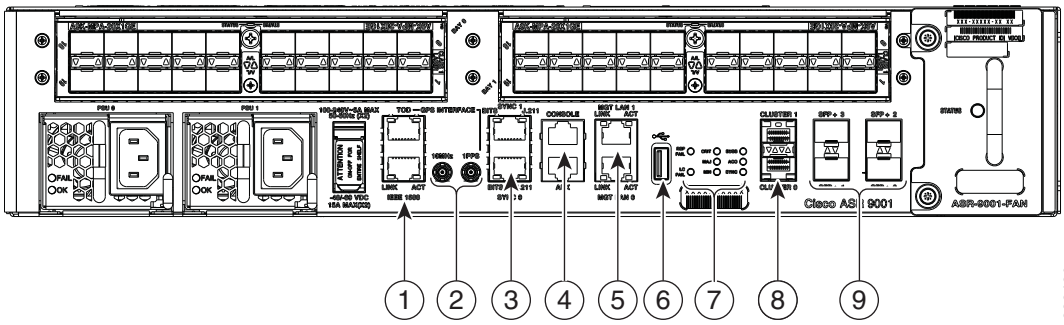
The Cisco ASR 9001 Router has four integrated 10 GE small form-factor pluggable (SFP+) ports that operate at a rate of 10 Gbps.

Each fixed SFP+ port has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP+ port.

Note In Cisco ASR 9001-S Router, two 10 GE fixed SFP+ ports (SFP+2 and SFP+3) are disabled by default, and can be enabled by a license upgrade.

Figure 3-1 shows the front panel of the chassis and connectors of the fixed 4x10-Gigabit Ethernet ports.

Figure 3-1 .4x10-Gigabit Ethernet SFP+ Ports



9	Fixed 10 GE SFP+ ports

Modular Port Adapters

The Cisco ASR 9001 Router has two ethernet pluggable ports that support these Modular Port Adapters (MPAs):

- 20-Port GE MPA
- 4-Port 10-GE MPA
- 2-Port 10-GE MPA

Note In Cisco ASR 9001-S Router, one ethernet pluggable port (MPA1) is disabled by default, and can be enabled by license upgrade.

20-Port Gigabit Ethernet Modular Port Adapter

The 20-Port Gigabit Ethernet modular port adapter provides 10 double-stacked SFP (20 total) cages that support either fiber-optic or copper Gigabit Ethernet transceivers.

Each SFP cage on the Gigabit Ethernet modular port adapter has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated SFP port, as described in Table 4-4.

Refer to Figure 3-2 for an example of the 20-Port Gigabit Ethernet Modular Port Adapter.

Figure 3-2 20-Port Gigabit Ethernet Modular Port Adapter

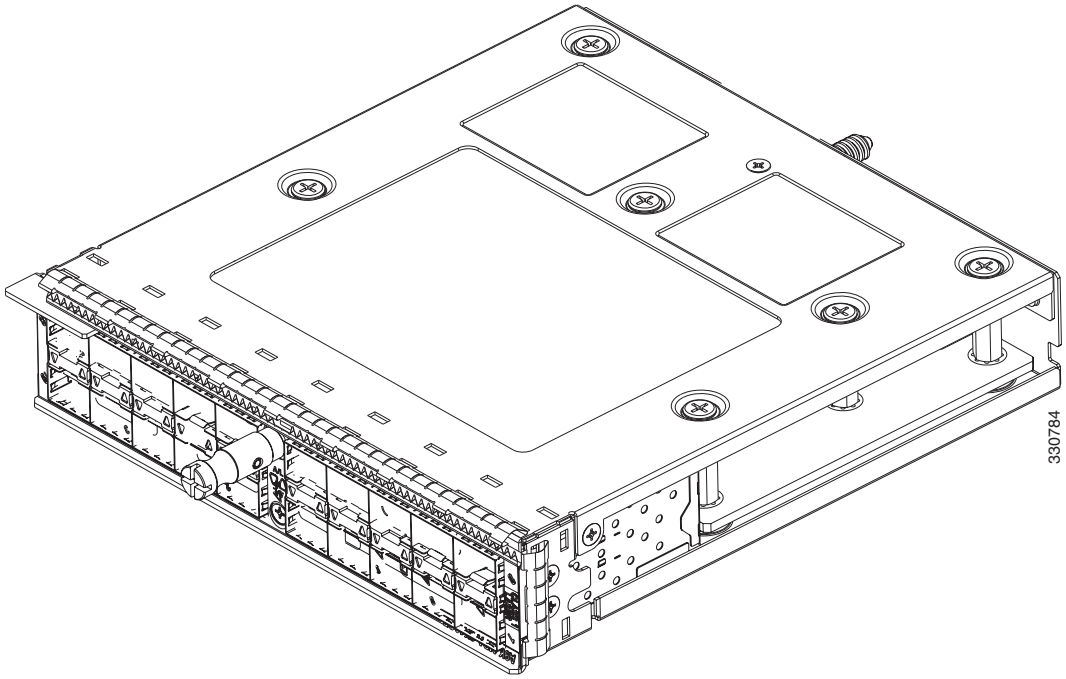


Table 3-1 describes the 20-Port Gigabit Ethernet modular port adapter LEDs.

Table 3-1 20-Port Gigabit Ethernet Modular Port Adapter LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L LED will blink green when there is traffic activity.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and modular port adapter is being configured.

4-Port 10 Gigabit Ethernet Modular Port Adapter

The 4-Port 10 Gigabit Ethernet modular port adapter provides four cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The four XFP modules can be 10-Gigabit Ethernet multimode or single mode connections.

Each XFP cage on the 4-Port 10 Gigabit Ethernet modular port adapter has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated XFP port, as described in Table 4-4.

Refer to Figure 3-3 for an example of the 4-Port 10 Gigabit Ethernet modular port adapter.

Figure 3-3 4-Port 10 Gigabit Ethernet Modular Port Adapter

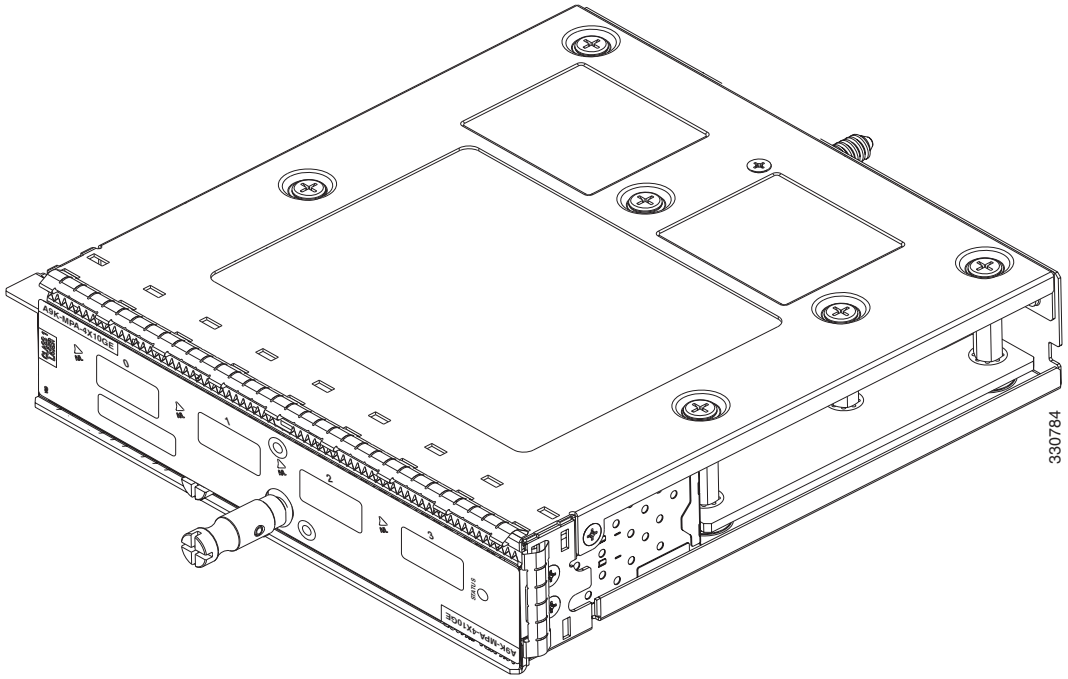


Table 3-2 describes the 4-Port 10 Gigabit Ethernet modular port adapter LEDs.

Table 3-2 4-Port 10 Gigabit Ethernet Modular Port Adapter LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L LED will blink green when there is traffic activity.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and the modular port adapter is being configured.

2-Port 10 Gigabit Ethernet Modular Port Adapter

The 2-Port 10 Gigabit Ethernet modular port adapter provides two cages for XFP Ethernet optical interface modules that operate at a rate of 10 Gbps. The two XFP modules can be 10-Gigabit Ethernet multimode or single mode connections.

Each XFP cage on the 2-Port 10 Gigabit Ethernet modular port adapter has an adjacent Link LED visible on the front panel. The Link LED indicates the status of the associated XFP port, as described in Table 4-4.

Refer to Figure 3-4 for an example of the 2-Port 10 Gigabit Ethernet modular port adapter.

Figure 3-4 2-Port 10 Gigabit Ethernet Modular Port Adapter

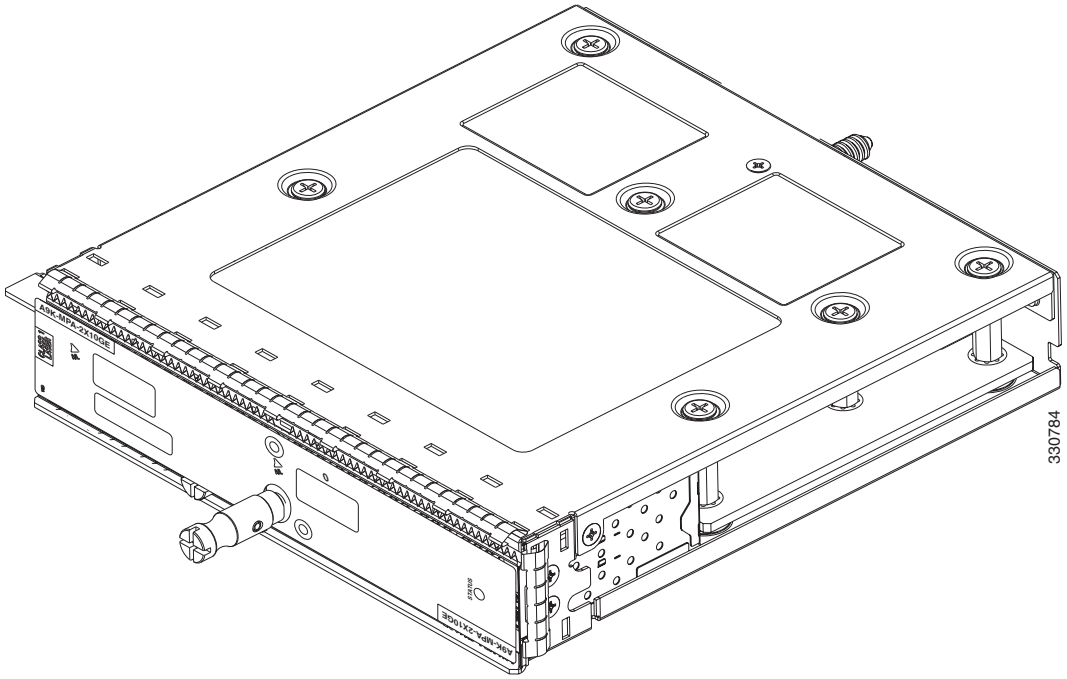


Table 3-2 describes the 2-Port 10 Gigabit Ethernet modular port adapter LEDs.

Table 3-3 2-Port 10 Gigabit Ethernet Modular Port Adapter LEDs

LED Label	Color	State	Meaning
A/L	Off	Off	Port is not enabled.
	Green	On	Port is enabled and the link is up. The MPA A/L LED will blink green when there is traffic activity.
	Amber	On	Port is enabled and the link is down.
STATUS	Off	Off	Modular port adapter power is off.
	Green	On	Modular port adapter is ready and operational.
	Amber	On	Modular port adapter power is on and good, and the modular port adapter is being configured.

Installing and Removing Modular Port Adapters

These sections describe how to install or remove modular port adapters (MPAs) on the Cisco ASR 9001 Router.

- Checking the Installation, page 3-8

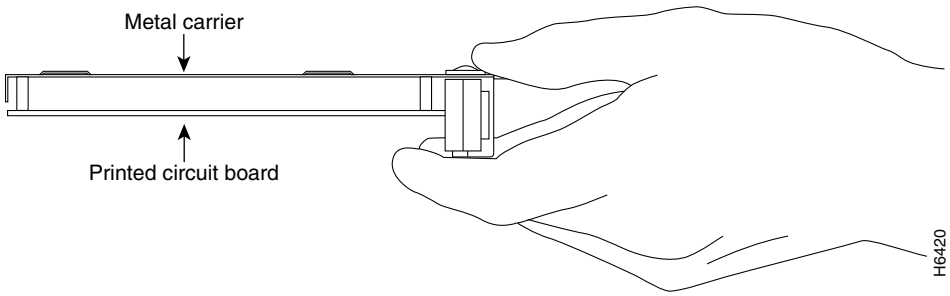
Handling Modular Port Adapters (MPAs)

Each modular port adapter (MPA) circuit board is mounted on a metal carrier, and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, refer to the *Preparing to Install Modular Line Cards (MLCs) or Modular Port Adapters (MPAs)* section of the *Cisco ASR 9000 Series Aggregation Services Router Ethernet Line Card Installation Guide* for a list of parts and tools required for installation.

Caution Always handle the modular port adapter (MPA) by the carrier edges and handle; never touch the modular port adapter (MPA) components or connector pins. (See Figure 3-5.)

When a bay is not in use, a blank ASR 9000 MPA Slot Filler (A9K-MPA-FILR) must fill the empty bay to allow the router or switch to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed modules. If you plan to install a modular port adapter (MPA) in a bay that is not in use, you must first remove the blank.

Figure 3-5 Handling a Modular Port Adapter (MPA)



Online Insertion and Removal

Cisco ASR 9001 Router modular port adapters (MPAs) support online insertion and removal (OIR).

Modular port adapters (MPAs) support three types of OIR:

- Soft OIR

  Soft OIR uses the IOS XR **hw-module subslot 0/0/1 reload**, **hw-module subslot 0/0/1 shutdown**, and **no hw-module subslot 0/0/1 shutdown** commands to complete online insertion and removal. Refer to the Hardware Redundancy and Node Administration Commands on the Cisco ASR 9000 Series Router chapter of the Cisco ASR 9000 Series Aggregation Services Router System Management Command Reference online for command syntax.

- Managed OIR

  A managed online insertion and removal of Modular port adapters (MPAs) is comprised of these steps:

  1. Shut down the MPA with the **hw-module subslot 0/0/1 shutdown** command.
  2. Confirm that the LEDs have gone from green to off.

3. Execute the **do show plat** command to verify that the MPA to be removed is in the disabled state.
4. Physically remove the MPA to be replaced.
5. Physically insert the replacement MPA
6. Return the MPA to the up state with the **no hw-module subslot 0/0/1 shutdown** command.

- Hard OIR

  Hard OIR is the physical online insertion and removal of Modular port adapters (MPAs) without software commands. Four types of hard OIR are supported:

  If the bay is empty when the Cisco ASR 9001 Router modular line card (MLC) boots you can do the following:

  – Insert a 20 GE MPA
  – Remove and then insert a replacement 20 GE MPA

  If the MLC boots with a 20 GE MPA in the bay you can remove and then insert a replacement 20 GE MPA

  If the MLC boots with a 4 10-GE MPA in the bay you can remove and then insert a replacement 4 10-GE MPA

  If the MLC boots with a 2 10-GE MPA in the bay you can remove and then insert a replacement 2 10-GE MPA

Note Only replacement with same types of MPA is supported by Managed OIR and Hard OIR. An empty bay during the Cisco ASR 9001 Router modular line card (MLC) bootup defaults to 20 GE MPA mode.

Modular Port Adapter (MPA) Installation and Removal

This section provides step-by-step instructions for removing and installing a modular port adapter (MPA).

Warning **When performing these procedures, wear a grounding wrist strap to avoid ESD damage to the modular port adapter (MPA). Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the midplane or backplane with your hand or any metal tool, or you could shock yourself.**

To remove and install a modular port adapter (MPA), perform these steps:

Step 1 To insert the modular port adapter (MPA), locate the guide rails that hold the modular port adapter (MPA) in place. They are at the top-left and top-right of the modular port adapter (MPA) slot and are recessed about an inch.

Step 2 Carefully slide the modular port adapter (MPA) all the way until it is firmly seated in the modular port adapter (MPA) interface connector.

Note The modular port adapter (MPA) will slide easily into the slot if it is properly aligned on the tracks. If the modular port adapter (MPA) does not slide easily, do NOT force it. Remove the modular port adapter (MPA) and reposition it, paying close attention to engaging it on the tracks.

Step 3 After the modular port adapter (MPA) is properly seated, use a number 2 Philips screwdriver to tighten the jackscrew on the modular port adapter (MPA).

Note Avoid over torquing the modular port adapter (MPA) jackscrew when installing the modular port adapter (MPA).

Step 4 To remove the modular port adapter (MPA), use a number 2 Philips screwdriver to loosen the lock screw on the modular port adapter (MPA).

Step 5 Grasp the modular port adapter (MPA) and pull the modular port adapter (MPA). (You have already disconnected the cables from the modular port adapter (MPA)).

Optical Device Installation and Removal

Any contamination of the fiber connection can cause failure of the component or failure of the whole system. A particle that partially or completely blocks the core generates strong back reflections, which can cause instability in the laser system. Inspection, cleaning, and reinspection are critical steps to take before making fiber-optic connections.

Cleaning Optical Devices

Refer to the *Inspection and Cleaning Procedures for Fiber-Optic Connections* document for information on cleaning optical devices.

Checking the Installation

This section describes the procedures you can use to verify the modular port adapter (MPA) installation, and includes information on these topics:

Verifying the Installation

This section describes how to verify the modular port adapter (MPA) installation by observing the modular port adapter (MPA) LED states.

When the system has reinitialized all interfaces, the modular port adapter (MPA) STATUS LEDs should be on (green). The port LEDs (C/A and A/L) may be on (green), depending on your connections and configuration.

Use this procedure to verify that a modular port adapter (MPA) is installed correctly:

Step 1 Observe the console display messages and verify that the system discovers the modular line card (MLC), while the system reinitializes each interface, thus:

- As a modular port adapter (MPA) is initialized, the STATUS LED will first be amber, indicating that power is on. When the modular port adapter card (MPA) is active, the STATUS LED will illuminate green.

Step 2 When the modular port adapter (MPA) STATUS LEDs are green, all associated interfaces are configurable.

- If a modular port adapter (MPA) is replaced with a module of the same type (as in an OIR or hardware swap), the previous configuration is reinstated when the modular port adapter (MPA) becomes active.
- If a modular port adapter (MPA) has not been previously installed in the same slot or subslot, then the configuration for all associated interfaces is empty.

Note New interfaces are not made available until you configure them.

Step 3 If the modular port adapters (MPAs) do not become active within three minutes, refer to the system console messages. If there is no indication that a field-programmable device (FPD) upgrade is underway, see Troubleshooting the Installation.

Using show Commands to Verify Modular Port Adapter (MPA) Status

This procedure uses **show** commands to verify that the new modular port adapters (MPAs) are configured and operating correctly.

Step 1 Use the **show running-config** command to display the system configuration. Verify that the configuration includes the new modular port adapter (MPA) interfaces.

Step 2 Use the **show diag** command to display information about the installed modular line cards (MLCs).

Step 3 Use the **show hw-module fpd location** <*rack/slot/subslot*> command to verify the FPD version information of the modular port adapters (MPAs) installed in the system.

Note If a modular port adapter (MPA) does not meet the minimum version required, the FPD may need to be updated. Refer to *Cisco ASR 9000 Series Aggregation Services Router System Management Configuration Guide* for instructions. If the update fails, the failing module is powered down and an error message displays on the system console.

Step 4 Use the **show platform** command to check the state of all boards in the chassis, including the modular line card (MLC) and the modular port adapters (MPAs).

The modular port adapter (MPA) state should be “OK” and the modular line card (MLC) card state should be “IOS XR RUN” in the **show platform** command output.

Step 5 Use the **show version** command to obtain software version information for the installed modular line cards (MLCs) as well as interfaces available.

Using show Commands to Display Modular Port Adapter (MPA) Information

Table 3-4 describes the **show** commands you can use to display modular port adapter (MPA) information.

Table 3-4 show Commands to Display Modular Port Adapter (MPA) Information

Command	Type of Information Provided
show running-config	Router's running configuration and interfaces available in the system.
show platform	Router's installed linecard and modular port adapter (MPA) type, slot, and state information.
show diag	Modular port adapter (MPA) type in that slot, number of ports, hardware revision, part number, and EEPROM contents.
show hw-module fpd location *<rack/slot/subslot>*	FPD version information of modular port adapters (MPAs) in the system.
show version	Cisco IOS XR software version, names and sources of configuration files, and boot images.

Table 3-5 show Commands to Display Modular Port Adapter (MPA) Information

Command	Type of Information Provided	Example
show controllers *type rack/slot/subslot/port*	Network link status, register contents, and controller chip errors.	**show controllers GigabitEthernet 0/0/1/1**
show interfaces *type rack/slot/subslot/port*	Line status and data link protocol status for a particular modular port adapter (MPA) port. Statistics about data traffic sent and received by the port.	**show interfaces GigabitEthernet 0/0/1/1**
show diag *rack/slot/subslot/*	Modular port adapter (MPA) type in that slot, number of ports, hardware revision, part number, and EEPROM contents.	**show diag 0/0/1**
show version	Cisco IOS XR software version and boot images.	**show version**

Using the ping Command to Verify Network Connectivity

The **ping** command allows you to verify whether a modular port adapter (MPA) port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. After you verify that the system and the modular line card (MLC) have booted successfully and are operational, you can use this command to verify the status of the modular port adapter (MPA) ports. Refer to *Cisco ASR 9000 Series Aggregation Services Router Getting Started Guide* and *Cisco ASR 9000 Series Aggregation Services Router Interface and Hardware Component Configuration Guide* for more information on bringing up and configuring the Cisco ASR 9000 Series Router and the Cisco ASR 9000 A9K-MOD80G-H.

The **ping** command sends an echo request out to a remote device at an IP address that you specify. After sending a series of signals, the command waits a specified time for the remote device to echo the signals. Each returned signal is displayed as an exclamation point (!) on the console terminal; each signal that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

This is an example of a successful **ping** command to a remote server with the IP address 10.1.1.60:

```
Router# ping 10.1.1.60
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.1.1.60, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination device and that the destination device is active (powered on), and then repeat the **ping** command.

Installing and Removing SFP Modules

Refer to the *Installing and Removing SFP Modules* section on the *Installing Line Cards in the Cisco ASR 9000 Series Router* chapter of the *Cisco ASR 9000 Series Aggregation Services Router Ethernet Line Card Installation Guide*.

Installing and Removing XFP Modules

Refer to the *Installing and Removing XFP Modules* section on the *Installing Line Cards in the Cisco ASR 9000 Series Router* chapter of the *Cisco ASR 9000 Series Aggregation Services Router Ethernet Line Card Installation Guide*.

Cable Management

Cisco ASR 9001 Router includes a cable-management system that organizes the interface cables entering and exiting the router, keeping them out of the way, and free of sharp bends.

Caution Excessive bending of interface cables can damage the cables.

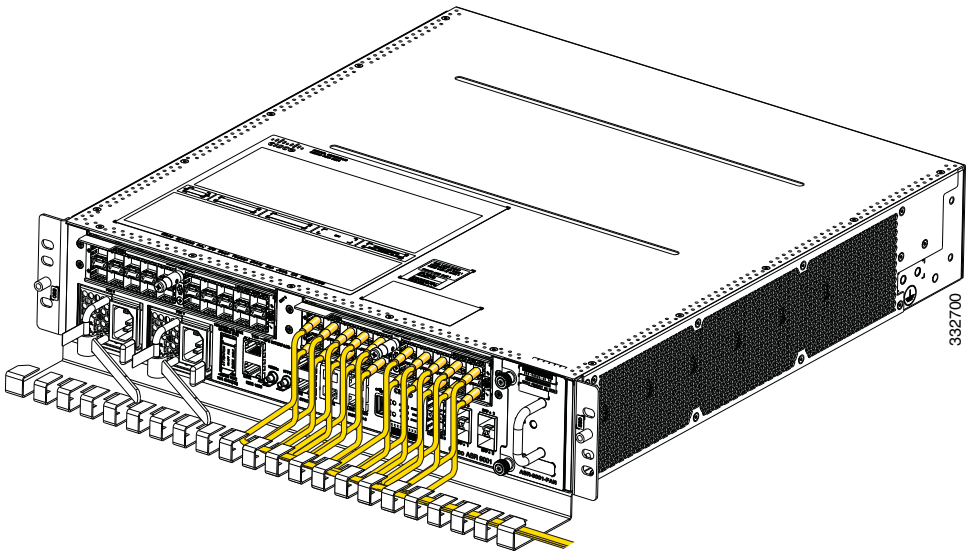
The cable-management system consists of thse separate components:

- A cable-management tray
- A cable-management bracket

Cable Management Tray

A cable-management tray is mounted at the bottom of the Cisco ASR 9001 Router chassis for routing interface cables to the RP. Figure 3-6 shows a typical cable routing through the cable-management tray.

Figure 3-6 Example Cable Routing through the Cisco ASR 9001 Router Cable Management Tray



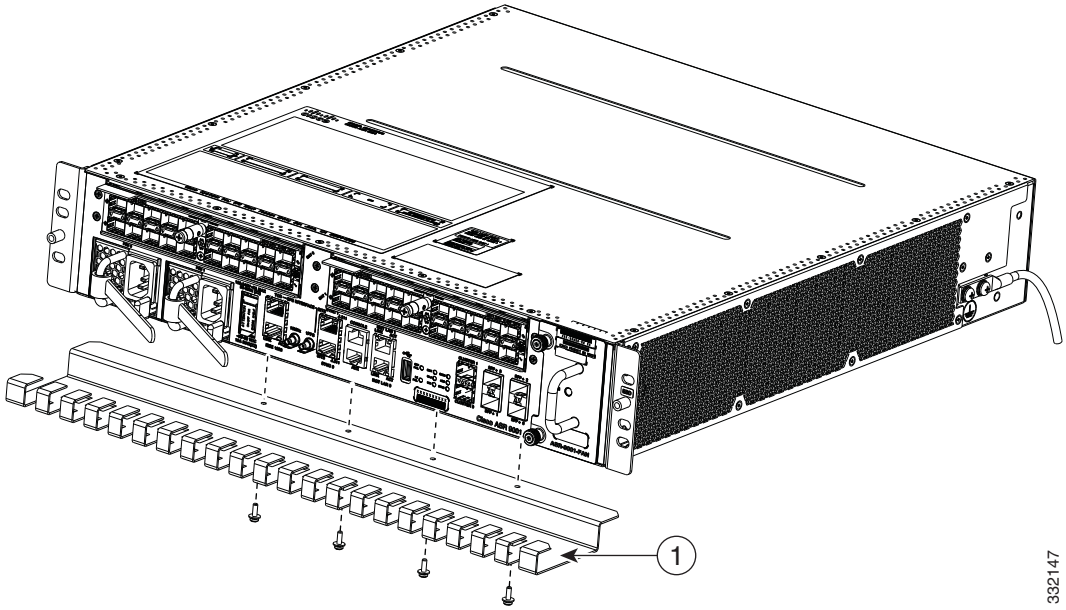
Installing a Cable Management Tray

To install a cable-management tray, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Position the cable-management tray at the bottom of the chassis front panel.

Figure 3-7 Cable-Management Tray Installation and Removal



1	Cable-Management Tray

Step 3 Insert and tighten the captive screw(s) to secure the tray. (see Figure 3-7).

Step 4 Connect all the cables to the intended ports and pass them throught the cable management tray in an organized manner.

Removing a Cable-Management Tray

To remove a cable-management tray, follow these steps (see Figure 3-7):

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Note the current interface cable connections to the ports on the RP.

Step 3 Starting with the interface cable for the bottom port on the RP, disconnect the cable from the RP interface.

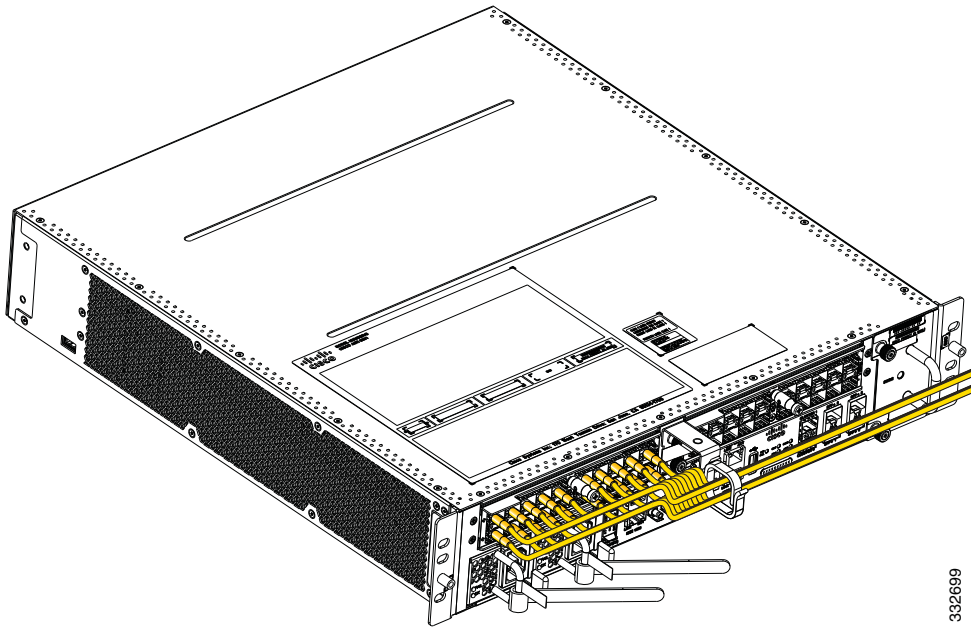
Step 4 Repeat Step 3 for all remaining interface cables, proceeding from the bottom ports upward, then proceed to Step 5.

Step 5 Loosen the captive installation screw on the cable-management tray and remove the tray from the chassis (see Figure 3-7).

Cable Management Bracket

The Cisco ASR 9001 Router provides a cable management bracket at the middle of the router chassis. Figure 3-8 shows a typical cable routing for the Cisco ASR 9001 Router.

Figure 3-8 Example Cable Routing through Cisco ASR 9001 Router Cable Management Brackets



Note When shipped, the cable-management bracket is not attached to the router chassis. You must attach the cable-management bracket to the chassis before you insert the cables into the line card ports.

Caution Do not use the cable-management bracket as a handle to pull out or push in the line card. The cable-management bracket is designed to hold the interface cables and may break if you use the bracket to push, pull, or carry the line card after it is removed from the router.

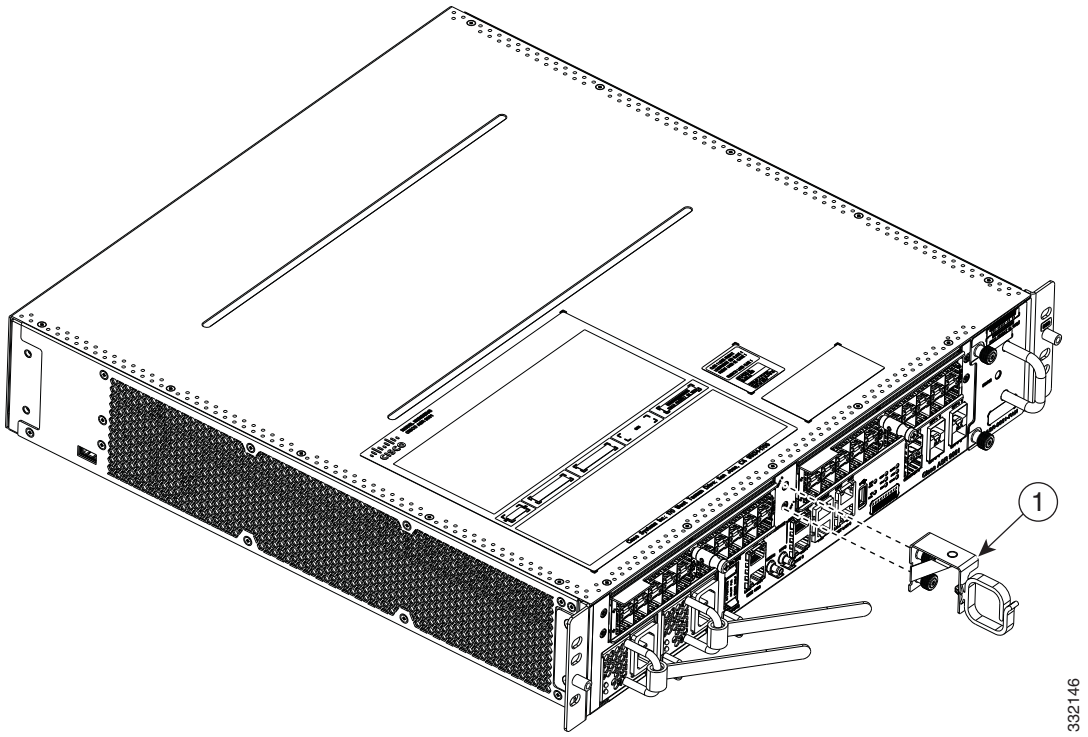
Installing a Cable Management Bracket

To install a cable-management bracket, follow these steps:

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Position the cable-management bracket over the front of the chassis front panel.

Figure 3-9 Cable-Management Bracket Installation and Removal



1	Cable-Management Bracket

Step 3 Insert and tighten the captive screw(s) to secure the bracket. (see Figure 3-9).

Step 4 Connect all the cables to the intended ports and pass them throught the cable management bracket in an organized manner.

Removing a Cable-Management Bracket

To remove a cable-management bracket, follow these steps (see Figure 3-9):

Step 1 Attach an ESD-preventive wrist or ankle strap and follow its instructions for use.

Step 2 Note the current interface cable connections to the ports on the RP.

Step 3 Starting with the interface cable for the bottom port on the RP, disconnect the cable from the RP interface.

Step 4 Repeat Step 3 for all remaining interface cables, proceeding from the bottom ports upward, then proceed to Step 5.

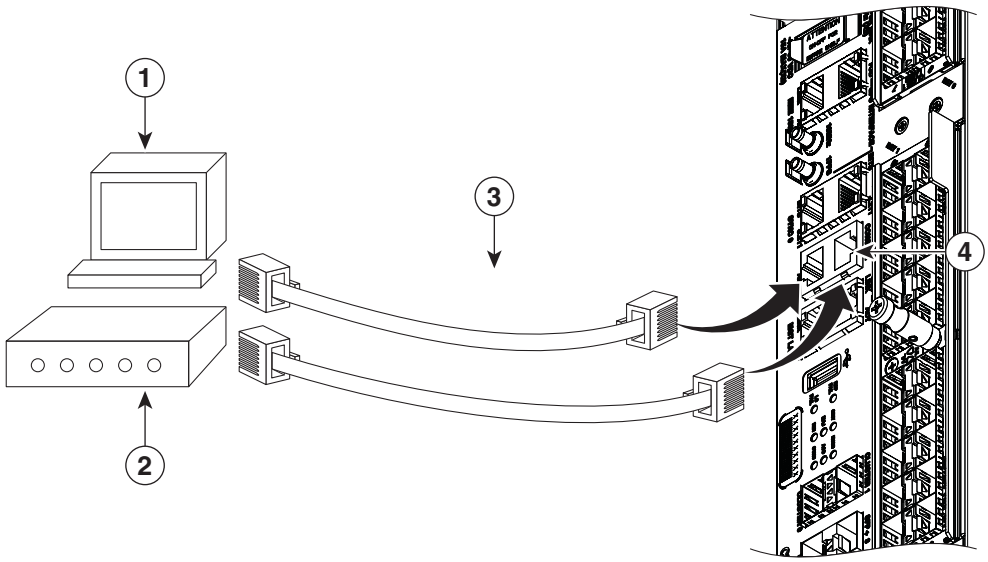
Step 5 Loosen the captive installation screw on the cable-management bracket and remove the bracket from the chassis (see Figure 3-9).

Connecting Route Processor Cables

This section describes how to connect cables to the console, auxiliary, and Ethernet ports on the RP. The console and auxiliary ports are both asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. Most modems are asynchronous devices.

Figure 3-10 shows an example of an RP with data terminal and modem connections called out.

Figure 3-10 RP Console and Auxiliary Port Connections



1	Console terminal	**3**	RJ-45 Ethernet cables
2	Modem	**4**	Console and Auxiliary port

Caution The ports labeled Ethernet, Console, and AUX are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits.

Note RP cables are not available from Cisco, but they are available from external commercial cable vendors.

Note To comply with the intra-building lightning surge requirements of Telecordia GR-1089-CORE, Issue II, Revision 01, February 1999, you must use a shielded cable when connecting to the console, auxiliary, and Ethernet ports. The shielded cable is terminated by shielded connectors on both ends, with the cable shield material tied to both connectors.

Connecting to the RP Console Port

The system console port on the RP is an RJ-45 receptacle for connecting a data terminal to perform the initial configuration of the router. The console port requires a straight-through RJ-45 cable.

See the "Cisco ASR 9001 Router Port Connection Guidelines" section on page 1-21 for additional information about the console port.

See Figure 3-10 and use this procedure to connect a data terminal to the RP console port:

Step 1 Set your terminal to these operational values: 115200 bps, 8 data bits, no parity, 1 stop bits (115200 8N1).

Step 2 Power off the data terminal.

Step 3 Attach the terminal end of the cable to the interface port on the data terminal.

Step 4 Attach the other end of the cable to the RP console port.

Step 5 Power on the data terminal.

Connecting to the RP Auxiliary Port

The auxiliary port on the RP is a RJ-45 receptacle for connecting a modem or other data communication equipment (DCE) device (such as another router) to the RP. The asynchronous auxiliary port supports hardware flow control and modem control.

See the "Cisco ASR 9001 Router Port Connection Guidelines" section on page 1-21 for additional information about the auxiliary port.

See Figure 3-10 and use this procedure to connect an asynchronous serial device to the RP auxiliary port:

Step 1 Power off the asynchronous serial device.

Step 2 Attach the device end of the cable to the interface port on the asynchronous serial device.

Step 3 Attach the other end of the cable to the RP auxiliary port.

Step 4 Power on the asynchronous serial device.

Connecting to the RP Ethernet Management Ports

To connect cables to the RP management ports, attach Category 5 UTP cables directly to the MGT LAN 0 and MGT LAN 1 RJ-45 receptacles on the RP.

See the "Management LAN Ports Connection Guidelines" section on page 1-24 for additional information about the Ethernet management LAN ports.

Note RJ-45 cables are not available from Cisco Systems; they are available from external commercial cable vendors. Use cables that comply with EIA/TIA-568 standards.

Caution Ethernet management ports are primarily used as Telnet ports into the Cisco ASR 9001, and for booting or accessing Cisco software images over a network to which an Ethernet port is directly connected. We strongly caution you to consider the security implications of enabling routing functions on these ports.

Note The Ethernet interfaces on the RP are end-station devices only, not repeaters.

Use this procedure to connect an Ethernet cable to the RP RJ-45 Ethernet receptacle:

Step 1 Plug the cable directly into the RJ-45 receptacle.

Step 2 Connect the network end of your RJ-45 cable to a switch, hub, repeater, or other external equipment.

Connecting Power to the Router

Use one of these procedures to connect power to your router.

- Connecting Power to an AC-Powered Router, page 3-18
- Connecting Power to a DC-Powered Router, page 3-20

Caution A router must be operated with all its power modules installed at all times for electromagnetic compatibility (EMC).

Connecting Power to an AC-Powered Router

Use this procedure to connect the AC power cords to the router.

Note Connect each AC power supply to a dedicated power source (branch circuit). Each AC-input power supply operates at a nominal input level of 100 to 240 VAC and requires at least a 15 A service for use in North America and Japan, or a 10 A service for international use. For more information on AC power input levels, see the "Power Connection Guidelines" section on page 1-12.

Step 1 Check that the power switch at the front of the chassis is set to the OFF position.

Step 2 Check that the circuit breaker assigned to the AC power source you are connecting is set to OFF.

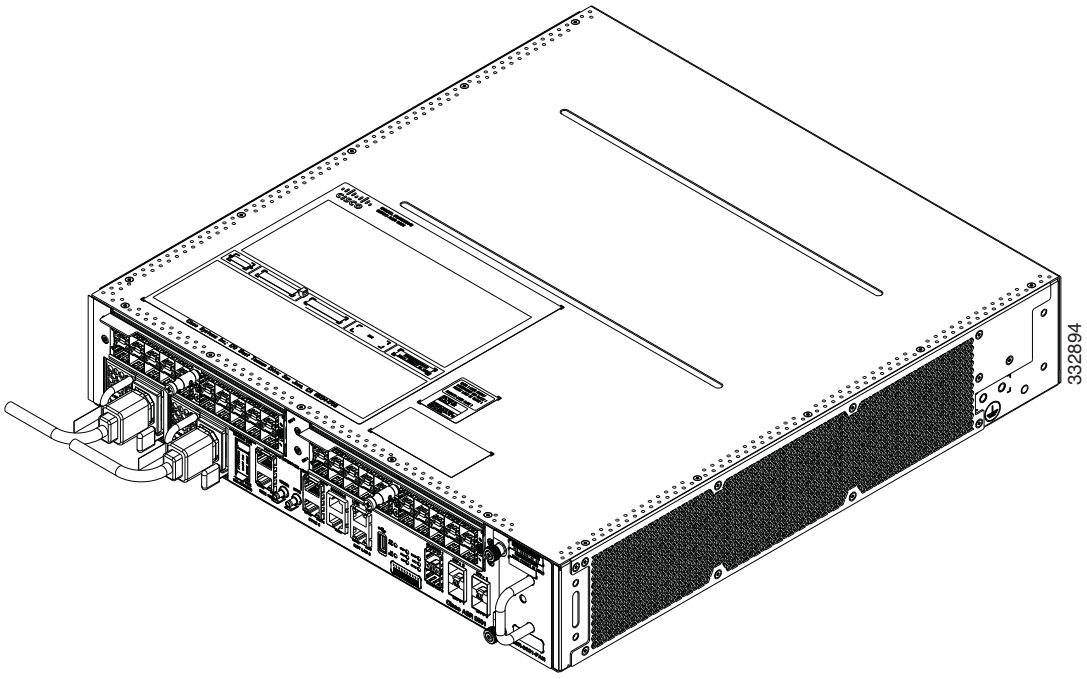
Step 3 Connect the permanent ground connection (central office grounding system) to the NEBS grounding location on the router chassis.

Note To ensure that power remains off while you are performing this procedure, turn the circuit breaker switch in the off (0) position until you are ready to turn it on.

Step 4 Plug the AC power cord into the receptacle at the front of the chassis (see Figure 3-11).

Step 5 Close the cable wrap to secure the AC power cord plug to the power module receptacle.

Figure 3-11 Typical AC Power Connections



Step 6 Plug the other end of the AC power cord into the AC source receptacle.

Step 7 Proceed to the "Powering on the Router" section on page 3-21.

Connecting Power to a DC-Powered Router

This section contains the procedures to connect the DC source power cables to a DC-powered router.

The color coding of source DC power cable leads depends on the color coding of the site DC power source. Because there is no color code standard for source DC wiring, you must be sure that power source cables are connected to the power module with the proper positive (+) and negative (–) polarity:

- In some cases, the source DC cable leads might have a positive (+) or a negative (–) label. This is a relatively safe indication of the polarity, *but you must verify the polarity by measuring the voltage between the DC cable leads*. Be sure that the positive (+) and negative (–) cable leads match the positive (+) and negative (–) labels on the power module when making the measurement.
- Green (or green and yellow) cable typically indicates that it is a ground cable.

Caution DC power modules contain circuitry to trip the breaker on the power module if the power module detects a reverse polarity condition. No damage would occur from reverse polarity, but you should correct a reverse-polarity condition immediately.

Note The length of the cables depends on the location of your router in relation to the source of DC power. These cables are not available from Cisco Systems. They are available from external commercial cable vendors. For more information on site power and source DC cable requirements, see the "Power Connection Guidelines" section on page 1-12.

Note To ensure that power remains off while you are performing this procedure, tape the DC circuit breaker switch in the off (0) position.

Use this procedure to connect the DC source power cables to a DC power module:

Step 1 Verify that the power switch is set to the OFF position.

Step 2 Connect the DC power cables in the following order (see Figure 3-12):

a. Ground cables first.

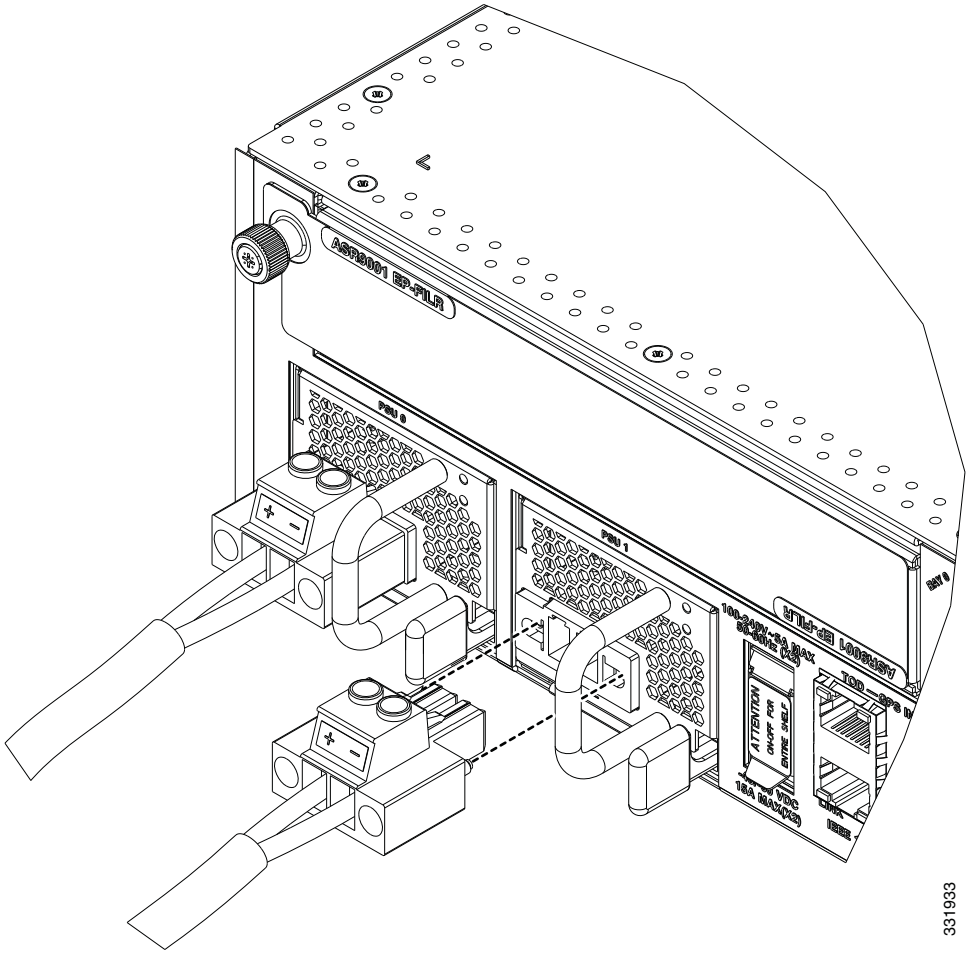
b. Positive cables next.

c. Negative cable last.

Step 3 Repeat Step 2 for the other power modules installed in the chassis.

Warning **To prevent injury and damage to the equipment, always attach the ground and source DC power cable to power module terminals in the following order: (1) ground to ground, (2) positive (+) to positive (+), (3) negative (–) to negative (–).**

Figure 3-12 Typical Power Connections for a Single DC Power Module



Step 4 Proceed to the "Powering on the Router" section on page 3-21.

Powering on the Router

Use this procedure to turn on power to either an AC-powered or DC-powered router:

Step 1 Power on the circuit breaker to your power sources.

Step 2 Verify that the Power Input LED on each power module is lit.

Step 3 Set the power switch to the ON position.

Step 4 Verify that the Green Power LED on each power module is lit.

CHAPTER 4

Troubleshooting the Installation

This chapter contains general troubleshooting information to help isolate the cause of any difficulties you might encounter during the installation and initial startup of the system.

Although an over-temperature condition is unlikely at initial startup, environmental monitoring functions are included in this chapter because these too monitor internal voltages.

Troubleshooting the installation is presented in these sections:

Troubleshooting Overview

This section describes the methods used in troubleshooting the router. The troubleshooting methods are organized according to the major subsystems in the router.

If you are unable to solve a problem on your own, you can contact a Cisco customer service representative for assistance. When you call, have this information ready:

- Date you received the router and the chassis serial number (located on a label on the back of the chassis).
- Installed line card and Cisco software release number:
  - Use the **show version** command to determine the Cisco software release number.
- Brief description of the symptoms and steps you have taken to isolate and solve the issue.
- Maintenance agreement or warranty information.

Troubleshooting Using a Subsystem Approach

To solve a system problem, try to isolate the problem to a specific subsystem. Compare the current router behavior with the expected router behavior. Because a startup issue is usually attributable to one component, it is most efficient to examine each subsystem, rather than trying to troubleshoot each router component.

For troubleshooting purposes in this chapter, the router consists of these subsystems:

- Power subsystem—Router chassis is shipped with up to two AC-input or DC-input power supply modules installed in the Cisco ASR 9001 Router chassis.
- Chassis backplane power distribution—System transfers +12 VDC power from the power modules to the chassis backplane and distributes it to all the cards through the backplane connectors. The fan tray receives power from the chassis backplane and communicate to the RP CAN Bus controller.
- Processor subsystem—Includes the active Route Processor (RP) card with line card. The RP is equipped with onboard processors. The RP downloads a copy of the Cisco software image to the line card processor.
- Cooling subsystem—Consists of one fantray with 14 fans, which circulate cooling air through the chassis.

Normal Router Startup Sequence

You can generally determine when and where the router failed during the startup sequence by checking the status LEDs on the power modules and RP.

In a normal router startup sequence, this sequence of events and conditions occur:

1. The fan in each power module receives power and begins drawing air through the power supply.

   The power module input power and output power indicators are on.
2. The fans in the fan tray receive power and begin drawing air through the chassis.

   The fan tray OK indicator is on.
3. As the power-on and boot process progresses for the RP, the status of the RP appears on the front panel of the card.

Identifying Startup Issues

Table 4-1 shows the LED states on the power modules (AC or DC), RP, and the fan tray after a successful system startup.

Table 4-1 LEDs at System Startup

Component	Type of Indicator	Display Contents/LED Status and Meaning
Line Card	Status LED	Green: The line card is enabled and ready for use.
AC Power Modules	Power status LEDs	Green (ON): Input AC power OK. Amber (OFF): No fault is present. The correct power module voltages are present and no faults have been detected.
DC Power Modules	Power status LEDs	Green (ON): Input DC power OK. Amber (OFF): No fault is present. The correct power module voltages are present and no faults have been detected.
Fan Tray	Fan tray status LED	Green (ON): Fan Tray OK. The fan tray fans are operating correctly.

Troubleshooting the Power Subsystem

This section contains information to troubleshoot the power subsystems:

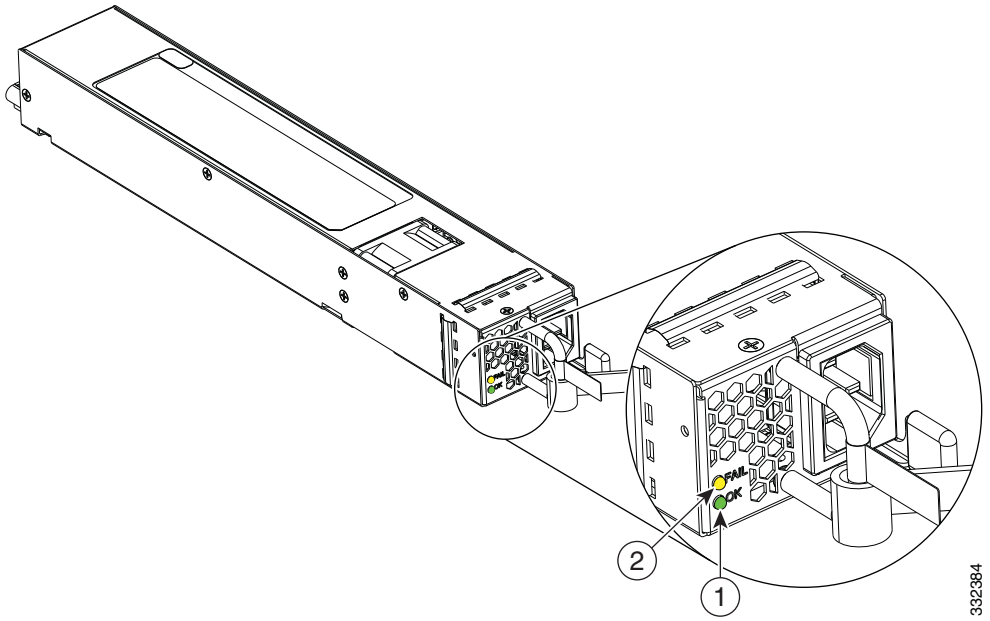
Note For the RP card to communicate properly to a power module, input power to at least one of the two power modules should be present.

Troubleshooting the AC-Input Power Subsystem

AC-input power modules are monitored for internal temperature, voltage, and current load by the RP. If the router detects an extreme condition, it generates an alarm and logs the appropriate warning messages on the console.

Figure 4-1 shows the status indicators for the power module. The indicator definitions are provided after the figure.

Figure 4-1 Power Module Status Indicators



1	OK (Green) Power LED	ON when the power supply is ON and OK BLINKING when the input AC power voltage is present OFF when no input voltage is present
2	FAIL (Amber) LED	ON when power supply failure occurs (due to over voltage, over current, over temperature, and fan failure) BLINKING when alarm condition or power supply warning events occur, where the power supply continues to operate (due to high temperature, high power, or slow fan) OFF when no power supply failure has occurred

Use this procedure to troubleshoot the AC power module if it is not operating properly:

Step 1 Make sure the power module is seated properly by ejecting and reseating the power module. Verify that:

- Latch on the ejector lever is locked securely.
- Power switch on the front panel is set to the ON position.

Step 2 Make sure the router is powered on and that all power cords are connected properly. Verify that:

- Power cables are securely attached to their power module terminal studs.
- Power cords at the power source end are securely plugged into their own AC power outlets.
- Source AC circuit breaker is switched on.

Step 3 Check the power supply status LED indicators:

- OK (green) Power LED—Indicates that the input AC power is OK.

  If the OK LED is blinking, AC power input is operating normally, and the source AC input voltage of 100 to 240 VAC is within the nominal operating range.

- FAIL (amber) LED —Indicates the power supply failure, includes over voltage, over current, over temperature and fan failure conditions.

  If the FAIL LED is blinking, it indicates alarm condition or power supply warning events, while the power supply continues to operate; this includes high temperature, high power, or slow fan conditions. Make sure that each power cord is connected to a dedicated AC power source. Verify that each AC power source is operating in the nominal range of 100 to 240 VAC and is supplying a minimum service of 15 A, North America (or 10 A, international).

Troubleshooting the DC-Input Power Subsystem

DC-input power supplies are monitored for internal temperature, voltage, and current load by the RP. If the router detects an extreme condition, it generates an alarm and logs the appropriate warning messages on the console.

Figure 4-1 shows the status indicators for the power module. The indicator definitions are provided after the figure.

Troubleshooting a DC Power Module

Use this procedure to troubleshoot a DC power module if it is not operating properly.

Step 1 Make sure the power module is seated properly by ejecting and reseating the power module. Verify that:

- Latch on the ejector lever is locked securely.
- Power switch on the front panel is set to the ON position.

Step 2 Make sure the router is powered on and that all power cords are connected properly. Verify that:

- Power cables are securely attached to their power module terminal studs.
- Power cables are securely attached at the DC source end.
- Source DC circuit breaker is switched on.

Step 3 Check the power supply status LED indicators:

- OK (green) Power LED—Indicates that the input DC power is OK.

  If the OK LED is blinking, DC power input is operating normally, and the source DC input voltage of –40 to –72 VDC is within the nominal operating range.

- FAIL (amber) LED —Indicates the power supply failure, includes over voltage, over current, over temperature and fan failure conditions.

  If the FAIL LED is blinking, it indicates alarm condition or power supply warning events, while the power supply continues to operate; this includes high temperature, high power, or slow fan conditions. Make sure that each power cable is connected to a dedicated DC power source. Verify that each DC power source is operating in the nominal range of –40 to –72 VDC.

Additional Power Subsystem Troubleshooting Information

This section contains additional troubleshooting information to help you isolate the cause of a power problem.

Hardware and Software Identification

The power modules have software IDs that differ from the hardware ID labels on the chassis. Table 4-2 is a table for converting power module hardware IDs to software IDs.

Table 4-2 Power Module Hardware and Software IDs

Hardware ID	Software ID
PS0 M0	PM0
PS0 M1	PM1

Obtaining Temperature and Environmental Information

If both the RP and the fan tray are operating, all internal correct DC voltages are present.

Enter the **show environment** command at the router admin prompt to display temperature and voltage information for each installed card, fan tray, and power module as shown in this example:

```
RP/0/RSP0/CPU0:router(admin)#show environment
Sat Apr 15 04:57:35.185 UTC

Temperature Information
-----------------------------------------------

R/S/I   Modules Sensor                  (deg C)
0/RSP0/*
        host    Inlet0                  31.1
        host    Inlet1                  30.3
        host    Hotspot0                45.8
        host    Hotspot1                38.3
        host    Hotspot2                45.5
        host    Hotspot3                46.0


0/0/*
        ep0     Inlet0                  33.1
        ep0     Hotspot0                38.5

        ep1     Inlet0                  33.6
        ep1     Hotspot0                37.5

        host    Hotspot0                43.5
        host    Hotspot1                37.8
        host    Hotspot2                45.7
        host    Hotspot3                41.6
        host    Hotspot4                45.9
        host    Inlet0                  36.0


Voltage Information
-----------------------------------------------

R/S/I   Modules Sensor                   (mV)   Margin
```

```
0/RSP0/*
        host    5.0V                    5000   n/a
        host    VP3P3_CAN               3299   n/a
        host    0.75V                    750   n/a
        host    3.3V_RSP                3299   n/a
        host    2.5V_RSP                2499   n/a
        host    1.8V_RSP                1799   n/a
        host    1.5V_RSP                1500   n/a
        host    1.2V_RSP                1199   n/a
        host    1.9V_LDO_RSP            1900   n/a
        host    1.2V_TIMEX              1199   n/a
        host    1.0V_IMIO_CORE          1000   n/a
        host    1.8V_USB                1799   n/a
        host    12.0V                  12004   n/a
        host    7.0V_RSP                7000   n/a
        host    3.3V_OCXO_RSP           3301   n/a
        host    1.0V_RSP                1000   n/a


0/0/*
        ep0     IBV                     7960   n/a
        ep0     VP3P3                   3319   n/a
        ep0     VP1P2                   1200   n/a
        ep0     VP1P2_PHY               1193   n/a
        ep0     VP3P3_AUX               3276   n/a

        ep1     VP2P5                   2499   n/a
        ep1     VP3P3                   3300   n/a
        ep1     VP1P2                   1200   n/a
        ep1     VP1P8                   1799   n/a
        ep1     VP5P0                   5000   n/a
        ep1     VP0P9_HEXP0              899   n/a
        ep1     VP0P9_LDO                900   n/a
        ep1     VP1P2_LDO               1199   n/a

        host    5.0V                    5000   n/a
        host    VP3P3_CAN               3299   n/a
        host    2.5V                    2500   n/a
        host    0.75V                    749   n/a
        host    2.5V_DB                 2499   n/a
        host    1.8V_DB                 1799   n/a
        host    7.0V                    6998   n/a
        host    VP1P0_SAC_CORE          1000   n/a
        host    VP1P0_SAC_VDDA          1000   n/a
        host    VP1P0_SAC_VDDD          1000   n/a
        host    VP1P2_SAC_VDDT          1199   n/a
        host    VP1P8_SAC_VDDR          1799   n/a
        host    VP1P0_SKT1_CORE         1000   n/a
        host    VP1P0_SKT2_CORE         1000   n/a
        host    VP1P0_CPU_CORE           999   n/a
        host    VP1P2                   1199   n/a
        host    VP1P5                   1500   n/a
        host    VP3P3_DB                3300   n/a
        host    VP1P5_DB                1499   n/a
        host    1.2V_BLWDO              1200   n/a
        host    1.0V_BLWDO              1000   n/a
        host    1.8V_LC                 1799   n/a
        host    1.0V_FPGA_CORE_LC        999   n/a
        host    1.2V_LC                 1199   n/a
        host    1.2V_PHY_LDO            1200   n/a
        host    0.9V_PHY_LDO             900   n/a
        host    0.9V_PHY_CORE            899   n/a
        host    1.0V_LC_MB               999   n/a
        host    3.3V_LC                 3300   n/a
```

```
        host    1.8V_ZAR_LDO            1799   n/a
        host    3.3V_ZAR_LDO            3300   n/a
        host    2.5V_SKT_SKM            2500   n/a
        host    1.8V_LGTNG              1800   n/a
        host    1.5V_NP4C_1             1500   n/a
        host    1.5V_SKT                1500   n/a
        host    1.05V_NP4C_CORE         1050   n/a
        host    1.0V_SKT                1000   n/a
        host    1.0V_SKM                 999   n/a
        host    1.0V_LGTNG_CORE         1000   n/a
        host    0.9V_TCAM0_CORE          910   n/a
        host    0.9V_TCAM1_CORE          909   n/a
        host    3.3V_CLK_LDO            3299   n/a
        host    2.5V_CLK_LDO            2499   n/a
        host    1.2V_WL_LDO             1199   n/a
        host    1.0V_WL_LDO              999   n/a
        host    1.0V_PEX1                992   n/a
        host    1.0V_PEX2                999   n/a
        host    1.5V_NP4C2              1500   n/a


LED Information
-----------------------------------------------

R/S/I   Modules LED             Status
0/RSP0/*
        host    Critical-Alarm  Off
        host    Major-Alarm     Off
        host    Minor-Alarm     Off
        host    ACO             Off
        host    Fail            Off
RP/0/RSP0/CPU0:ios#
```

Troubleshooting the Power Distribution System

The power distribution system consists of:

- AC or DC power modules that supply +12 VDC to the backplane.
- Chassis backplane that carries voltage to chassis components.
- DC-to-DC converters that convert +12 VDC from the backplane to the correct voltages required by the line card.

Use this procedure to troubleshoot the power distribution system:

Step 1 Check each power module to make sure that:

- Power module is fully inserted and properly secured by its latch.
- Green LED is on.
- Amber LED is off.

If the power modules meet the above criteria, then the correct source power is present and within tolerance, and output DC power is present. The power modules are functioning properly.

Step 2 Make sure the fan tray is operating:

- If the fan tray is functioning, then the +12 VDC from the chassis backplane to the fan tray is functioning properly.

- If the fan tray is still not operating, there could be a problem with either the fan tray or with the +12 VDC distribution through backplane.
- Contact your Cisco representative if replacing the fan tray does not fix the problem.

Troubleshooting the Route Processor Subsystem

The router processor subsystem consists of the route processor located on the RP card. The RP and the line card each has the same onboard CPU serving as the main processor. The Controller Area Network (CAN) microcontroller processor monitors the environment and controls the onboard DC-to-DC converters.

This section contains information to troubleshoot the route processor subsystem, including:

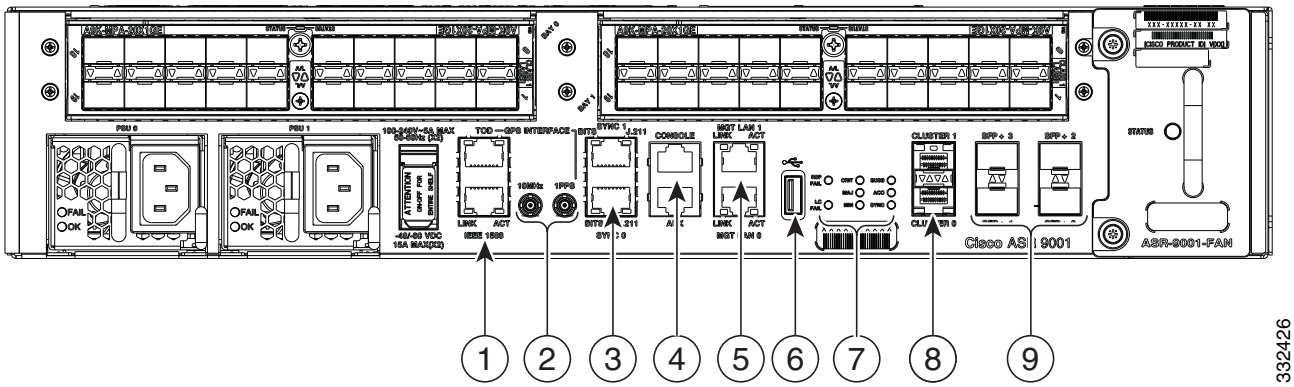
- Route Processor Overview, page 4-9
- Configuring and Troubleshooting Line Card Interfaces, page 4-13

Route Processor Overview

The CPU on the RP card provides chassis control and management, boot media functionality, telecom timing and precision clock synchronization, communication to the line card through the backplane Ethernet network, and power control through the CAN bus. In addition, the CPU on the RP card also runs the routing protocols.

Figure 4-2 identifies the slots, ports, and LEDs on the RP card front panel.

Figure 4-2 Cisco ASR 9001 Router Chassis Front Panel



1	Service LAN and ToD ports	**6**	External USB port
2	10MHz and 1PPS indicators	**7**	Eight discrete LED indicators
3	SYNC (BITS/J.211) ports	**8**	CLUSTER ports
4	CONSOLE and AUX ports	**9**	Line Card SFP+ ports
5	Management LAN ports		

RP Front Panel Indicators

The RP card has eight discrete LED indicators for display of system information.

Table 4-3 lists the display definitions of the eight discrete LEDs on the RP front panel as well as the normal LED states on the power modules (AC or DC) and the fan tray after a successful system startup.

Table 4-3 RP Discrete LED Display Definitions

Indicator (Label)	LED	Color	Description
RSP FAIL	Bi-color	Red	RSP in initializing or failed state.
		Green	RSP is up and running.
		Off	RSP is normal.
LC FAIL	Bi-color	Red	LC in initializing or failed state.
		Green	LC is up and running.
		Off	LC is normal.
Critical Alarm (CRIT)	Single color	Red	Critical Alarm LED. A critical alarm has occurred.
		Off (Default after reset)	No critical alarm has occurred.
Major Alarm (MAJ)	Single color	Red	Major alarm LED. A major alarm has occurred.
		Off (Default after reset)	No major alarm has occurred.
Minor Alarm (MIN)	Single color	Amber	Minor alarm LED. A minor alarm has occurred.
		Off (Default after reset)	No minor alarm has occurred.
External USB 2.0 (EUSB)	Single color	Green	External USB is busy/active. The LED is driven by the USB controller.
		Off (Default after reset)	External USB is not busy/active.
Alarm Cutoff (ACO)	Single color	Amber	Alarm Cutoff has been enabled. The ACO push button was pressed after at least one alarm has occurred.
		Off (Default after reset)	Alarm Cutoff is not enabled. **Note:** ACO LED is not in use and will always be OFF.
Synchronization (SYNC)	Bi-color	Green	Sync - Time core is synchronized to an external source (either GPS or IEEE1588).
		Amber	Not used.
		Off (Default after reset)	Time core clock synchronization is either disabled OR Time core is synchronized with external source excluding GPS and IEEE1588
FAIL/OK (Power Module)	Bi-color	Green	Refer Figure 4-1 for detailed description.
		Amber	Refer Figure 4-1 for detailed description.

Table 4-3 RP Discrete LED Display Definitions (continued)

Indicator (Label)	LED	Color	Description
STATUS (Fan tray)	Bi-color	Amber	Fan tray power ON state.
		Green	Fan tray fully functional.
		Red	Fan failure condition.

Ethernet Ports and Status LEDs

The RP has two 8-pin media-dependent interface (MDI) RJ-45 Management LAN ports for 10 Mbps, 100 Mbps, and 1000Mbps Ethernet connections. These ports are labeled MGT LAN 0 and MGT LAN 1.

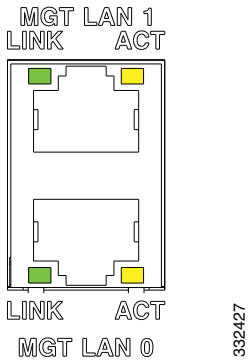
The transmission speed of the Ethernet port is not user-configurable. You set the speed through an auto-sensing scheme on the RP, the speed is determined by the network to which the Ethernet port is connected. However, even at an auto-sensed data transmission rate of 100 Mbps, the Ethernet port can only provide a usable bandwidth of substantially less than 100 Mbps. You can expect a maximum usable bandwidth of approximately 12 Mbps when using an Ethernet connection.

These LEDs on the front panel indicate traffic status and port selection (see Figure 4-3):

- LINK—Indicates link activity.
- ACT—Indicates which Ethernet port is selected (ETH 0 or ETH 1).

Note Because both ports are supported on the RP card, MGT LAN 0 is always on. MGT LAN 0 lights when it is selected.

Figure 4-3 Management LAN Port Activity LEDs



Auxiliary and Console Ports

The auxiliary and console ports on the RP are EIA/TIA-232 (also known as RS-232) asynchronous serial ports connect external devices to monitor and manage the system:

- Auxiliary port—RJ45 interface that supports flow control and is often used to connect a modem, a channel service unit (CSU), or other optional equipment for Telnet management.
- Console port—Receptacle (female) that provides a RJ45 interface for connecting a console terminal.

Monitoring Critical, Major, and Minor Alarm Status

Alarms warn of:

- Overtemperature condition on a component in the card
- Fan failure in the fan tray
- Overcurrent condition in a power supply
- Out-of-tolerance voltage on the card

The alarm LEDs are controlled by the CAN microcontoller software, which sets the threshold levels for triggering the different stages of alarms.

The RP card continuously polls the system for temperature, voltage, current, and fan speed values. If a threshold value is exceeded, the RP sets the appropriate alarm severity level on the alarm card, which lights the corresponding LED, and energizes the appropriate alarm display relays to activate any external audible or visual alarms wired to the alarm display. The RP also logs a message about the threshold violation on the system console.

Note If one or more of the alarm LEDs is on, check the system console for messages describing the alarm.

Troubleshooting the Line Card

Initial Boot Process

During a typical line card boot process, thse events occur:

1. The line card receives power and begins executing initialization software.
2. The line card performs internal checks, and prepares to accept the Cisco IOS XR software from the RP.
3. The RP loads the line card with its Cisco IOS XR software.

To verify that the line card is working properly:

Step 1 Check that the LC FAIL LED is ON (green) to verify that the card is operating normally.

Step 2 Check that the RSP FAIL LED for the port of interest is ON (green or blinking) to verify that the port is active. If the RSP FAIL LED is not ON, verify that the associated interface is not shut down.

Step 3 If one of the conditions above is not met, see the "Advanced Line Card Troubleshooting" section on page 4-17 to identify any possible problems.

Status LEDs

You can use the LC FAIL LED or the RSP FAIL LED on the RP card front panel to verify proper operation or troubleshoot a failure (see Table 4-4).

Table 4-4 RSP FAIL and LC FAIL LEDs

RSP FAIL LED	
Green	Port state is up and a valid physical layer link is established.
Blinking	Line activity is occurring. The LED blinks green-amber-green.
Red	Port state is up, but there is a link loss or SFP/XFP failure.
Off	Port is administratively shut down.
LC FAIL LED	
Green	Line card has booted properly, and is ready to pass or is passing traffic.
Red	Line card has encountered a hardware error, and is not passing traffic.
Off	Line card is powered off. The LED might turn off momentarily when switching between the states described above, although the line card has not powered off.

Configuring and Troubleshooting Line Card Interfaces

After the person who installed the hardware verifies that the line card is working properly by examining the LEDs, the network administrator can configure the new interface. These sections provide information on configuring and troubleshooting the line card:

- Configuration Parameters, page 4-13
- Line Card Interface Address, page 4-14
- Using Configuration Commands, page 4-14
- Basic Line Card Configuration, page 4-14
- Verifying the Transceiver Modules, page 4-15
- Advanced Line Card Troubleshooting, page 4-17

Configuration Parameters

Table 4-5 lists the default interface configuration parameters that are present when an interface is enabled on a 10-Gigabit Ethernet line card. See Cisco IOS XR software documentation for complete information about these parameters.

Table 4-5 Line Card Configuration Default Values

Parameter	Configuration File Entry	Default Value
Flow control	**flow-control**	egress on ingress off
MTU	**mtu**	1514 bytes for normal frames 1518 bytes for IEEE 802.1Q tagged frames 1522 bytes for Q-in-Q frames
MAC address	**mac address**	Hardware burned-in address (BIA)

Line Card Interface Address

A Cisco ASR 9001 Router identifies an interface address by its rack number, line card slot number, instance number, and port number, in the format *rack/slot/instance/port*. The *rack* parameter is reserved for multirack systems; so, the *rack* parameter is always 0 (zero) for the Cisco ASR 9001 Router.

The line card slot is numbered 0 with three subslots. The subslots on the line card are numbered 0, 1, and 2. 0 and 1 are reserved for EP ports and 2 is for native ports on the line card. Even if the line card contains only one port, you must use the *rack/slot/instance/port* notation.

Using Configuration Commands

The command line interface (CLI) for Cisco IOS XR software is divided into different command modes. To configure a line card, you enter the correct mode and then enter the commands you need.

When you first log in, you are automatically in EXEC mode. Next, enter the **configure** command to access configuration mode. Then, enter the **interface** command to enter interface configuration mode and specify the interface. You are now in the command mode where you can configure the new interface. Be prepared with the information you will need, such as the interface IP address.

Basic Line Card Configuration

This procedure is for creating a basic configuration—enabling an interface and specifying IP routing. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration.

This example shows one way to configure the basic parameters of a line card:

Step 1 Enter EXEC mode:

```
Username: username
Password: password
RP/0/RSP0/CPU0:router#
```

Step 2 Check the status of each port by entering the **show interface** command:

```
RP/0/RSP0/CPU0:router# show interface
```

Step 3 Enter global configuration mode and specify that the console terminal will be the source of the configuration commands:

```
RP/0/RSP0/CPU0:router# configure terminal
```

Step 4 At the prompt, specify the new interface to configure by entering the **interface** command, followed by the *type* (for example, **gigabitethernet** or **tengige**) and *rack/slot/instance/port* (line card rack, slot number, subslot number, port number). Remember that Cisco ASR 9001 Router rack and subslot values are always 0 (zero). For example, to configure port 4 on bay 0 of the line card:

```
RP/0/RSP0/CPU0:router# interface tengige 0/0/0/3
```

You are now in interface configuration mode.

Step 5 Assign an IP address and subnet mask to the interface with the **ipv4 address** configuration subcommand, as in the following example:

```
RP/0/RSP0/CPU0:router(config-if)# ipv4 address 10.1.2.3 255.255.255.0
```

Step 6 Use the **no shutdown** command to enable the interface:

```
RP/0/RSP0/CPU0:router(config-if)# no shutdown
```

The **no shutdown** command passes an **enable** command to the line card. It also causes the line card to configure itself based on the most recent configuration commands received by the line card.

Step 7 If you want to disable the Cisco Discovery Protocol (CDP), which is not required, use this command:

```
RP/0/RSP0/CPU0:router(config-if)# no cdp
```

Step 8 Add any other configuration subcommands required to enable routing protocols and adjust the interface characteristics. Examples of such subcommands are:

```
RP/0/RSP0/CPU0:router(config-if)# flow-control ingress
RP/0/RSP0/CPU0:router(config-if)# mtu 1448
RP/0/RSP0/CPU0:router(config-if)# mac-address 0001.2468.ABCD
```

Step 9 When you have included all the configuration subcommands to complete the configuration, enter the **commit** command to commit all changes you made to the running configuration.

```
RP/0/RSP0/CPU0:router(config-if)# commit
```

Step 10 Enter **Ctrl-Z** to exit configuration mode. If you did not enter the **commit** command, you will be prompted to do so:

```
RP/0/RSP0/CPU0:router(config-if)#
Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:
```

Answer **yes** to commit, **no** to exit without a commit, or **cancel** to cancel the exit (default).

Step 11 Write the new configuration to memory:

```
RP/0/RSP0/CPU0:router# copy run disk0:/config/running/alternate_cfg:/router.cfg
Destination file name (control-c to abort): [/router.cfg]?
The destination file already exists. Do you want to overwrite? [no]: yes
Building configuration.
223 lines built in 1 second
[OK]
```

The system displays an OK message when the configuration has been stored.

Verifying the Transceiver Modules

Use the **show inventory all** command to display SFP or XFP module information for all transceiver modules currently installed in the router. To display SFP or XFP module information for a particular module, you can use the **show inventory location** <*slot ID*> command**.**

The output of these commands lists such information as the slot ID, transceiver type, description, product ID, version, and serial number.

For example, to list module information for all modules in the router:

```
RP/0/RSP0/CPU0:router# show inventory all
Mon Mar 26 13:08:28.805 UTC
NAME: "module 0/RSP0/CPU0", DESCR: "ASR9001CHASSIS"
PID: ASR-9001, VID: V00, SN: FOC154682GG

NAME: "module 0/0/CPU0", DESCR: "ASR9001CHASSIS"
PID: ASR-9001, VID: V00, SN: FOC1547809S

NAME: "module 0/0/0", DESCR: "ASR 9000 4-port 10GE Modular Port Adapter"
PID: A9K-MA-4X10GE, VID: V01, SN: FOC1539862S
```

```
NAME: "module mau 0/0/0/0", DESCR: "XFP"
PID: XFP-10G-MM-SR       , VID: V02 , SN: ONT1535101F

NAME: "module mau 0/0/0/1", DESCR: "XFP"
PID: XFP-10G-MM-SR       , VID: V01 , SN: ONT15011038

NAME: "module mau 0/0/0/2", DESCR: "XFP"
PID: XFP-10G-MM-SR       , VID: V02 , SN: ONT1535103K

NAME: "module mau 0/0/0/3", DESCR: "XFP"
PID: XFP-10G-MM-SR       , VID: V01 , SN: ONT150111N5

NAME: "module 0/0/1", DESCR: "ASR 9000 20-port 1GE Modular Port Adapter"
PID: A9K-MPA-20X1GE, VID: V01, SN: FOC155181Q7

NAME: "module mau 0/0/1/0", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501BQS

NAME: "module mau 0/0/1/1", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: AGM1501P2VN

NAME: "module mau 0/0/1/2", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501BDQ

NAME: "module mau 0/0/1/3", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501YHS

NAME: "module mau 0/0/1/4", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501YJA

NAME: "module mau 0/0/1/5", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AJD

NAME: "module mau 0/0/1/6", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501SPE

NAME: "module mau 0/0/1/7", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AHA

NAME: "module mau 0/0/1/8", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AGX

NAME: "module mau 0/0/1/9", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AKF

NAME: "module mau 0/0/1/10", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501BDT

NAME: "module mau 0/0/1/11", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501BET

NAME: "module mau 0/0/1/12", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AKX

NAME: "module mau 0/0/1/13", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AJ5

NAME: "module mau 0/0/1/14", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AK4

NAME: "module mau 0/0/1/15", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS155009QS

NAME: "module mau 0/0/1/16", DESCR: "SFP"
```

```
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AJX

NAME: "module mau 0/0/1/17", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS155009TE

NAME: "module mau 0/0/1/18", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS155009TR

NAME: "module mau 0/0/1/19", DESCR: "SFP"
PID: SFP-GE-S            , VID: V01 , SN: FNS15501AJQ

NAME: "module mau 0/0/2/0", DESCR: "SFP"
PID: SFP-10G-SR          , VID: V03 , SN: SPC1503050L

NAME: "module mau 0/0/2/1", DESCR: "SFP"
PID: SFP-10G-SR          , VID: V03 , SN: FNS15210Q2K

NAME: "module mau 0/0/2/2", DESCR: "SFP"
PID: SFP-10G-SR          , VID: V03 , SN: SPC150305MD

NAME: "module mau 0/0/2/3", DESCR: "SFP"
PID: SFP-10G-LR          , VID: V02 , SN: ECL150200Y9
```

Advanced Line Card Troubleshooting

This section briefly describes advanced troubleshooting commands that can be used if a line card fails.

Note This section assumes that you possess basic proficiency in the use of Cisco IOS XR software commands.

By using the commands listed in this section, you should be able to determine the nature of the problems you are having with your line card. The first step is to identify the cause of the line card failure or console errors that you are seeing.

To discover which card may be at fault, it is essential to collect the output from these commands:

- **show logging**
- **show diag** *slot*
- **show context location** *slot*

Along with these **show** commands, you should also gather the following information:

- Console Logs and Syslog Information—This information is crucial if multiple symptoms are occurring. If the router is configured to send logs to a Syslog server, you may see some information on what has occurred. For console logs, it is best to be directly connected to the router on the console port with logging enabled.
- Additional Data—The **show tech-support** command is a compilation of many different commands, including **show version**, **show running-config**, **show tech ethernet**, **show tech pfi**, and **show stacks**. This information is required when working on issues with the Cisco Technical Assistance Center (Cisco TAC).

For examples of how to use these commands and the resulting output, see the *Cisco ASR 9000 Series Troubleshooting Guide*.

Note It is important to collect the **show tech-support** command data before doing a reload or power cycle. Failure to do so can cause all information about the problem to be lost. Output from these commands varies slightly depending on which line card you are using, but the basic information is the same.

Troubleshooting the Cooling Subsystem

You may need to troubleshoot the cooling subsystem if an over-temperature condition occurs. The cooling subsystem of the router consists of a fan tray in the chassis and a fan in each of the power supplies. The fan tray and the power supply fans circulate air to maintain acceptable operating temperatures within the router.

This section contains information to troubleshooting the cooling subsystem and includes:

Fan Tray Operation

The fan tray maintains acceptable operating temperatures for the internal components by drawing cooling air into the system chassis. The fan tray receives power from the chassis backplane.

The fan tray contains 14 fans, a controller card, and one front panel STATUS LED indicator:

- Green—Fan tray is functioning properly.
- Red—There is a fault detected in the fan tray.

If the air temperature inside the chassis rises, blower speed increases to provide additional cooling air to the internal components. If the internal air temperature continues to rise beyond the specified threshold, the system environmental monitor shuts down all internal power to prevent equipment damage because of excessive heat.

If the system detects that one or more of the fans in the fan tray has failed, it displays a warning message on the system console. In addition, the remaining fans go to full speed to compensate for the loss of the failed fan.

Power Module Fans

Each AC or DC power module is equipped with one fan that draws cooling air in through the front of the power module and force warm air out through the air exhaust of the chassis:

- If the power source is within the required voltage range, the power supply fan remains on.
- If a fan fails:
  - Power module detects an internal over-temperature condition.
  - Fault and Temp indicators light.
  - Power module sends an over-temperature warning to the system and then power supply switchover to the redundant power module.

For additional power supply troubleshooting information, see the "Troubleshooting the Power Subsystem" section on page 4-3.

Note For the RSP to communicate properly to a power module, input power to at least one of the two power modules should be present.

Over-temperature Conditions

This console error message indicates that the system has detected an over-temperature condition or out-of-tolerance power value inside the system:

```
Queued messages:
%ENVM-1-SHUTDOWN: Environmental Monitor initiated shutdown
```

The preceding message could also indicate a faulty component or temperature sensor. Enter the **show environment** command or the **show environment all** command at the user EXEC prompt to display information about the internal system environment. The information generated by these commands includes:

- Voltage measurements on each card from the DC-to-DC converter
- The +5 VDC for the I2C module
- Operating voltage for the fan tray
- Temperature measurements received by all sensors of RP and LC module as well as temperature measurements from sensors located in each power module

If an environmental shutdown results from an over-temperature or out-of-tolerance condition, the Fault indicator on the power supply lights before the system shuts down.

Although an over-temperature condition is unlikely at initial system startup, make sure that:

- Heated exhaust air from other equipment in the immediate environment is not entering the chassis card cage vents.
- You allow sufficient air flow by maintaining a minimum of 6 inches (15.24 cm) of clearance at both the inlet and exhaust openings on the chassis and the power modules to allow cool air to enter freely and hot air to be expelled from the chassis.

Isolating Cooling Subsystem Problems

Use this procedure to isolate a problem with the chassis cooling system if you have an over-temperature condition:

Step 1 Make sure the fan tray is operating properly when you power on the system. To determine if the fan tray is operating, check the LED indicator on the fan tray front panel:

- OK (green)—Fan tray is functioning properly and receiving +12 VDC power, indicating that the cables from the chassis backplane to the fan tray are good.
- Fail (red)—Fault is detected in the fan tray. Replace the fan tray.
- If neither indicator is on and the blower is not operating, there may be a problem with either the fan tray or the +12 VDC power supplied to the fan tray. Go to Step 2.

Step 2 Eject and reseat the fan tray making sure the captive screws are securely tightened to a torque of 10 +/–1 in-lb.

If the fan tray still does not function, go to Step 3.

Step 3 Check for +12 VDC power by looking at the LED indicators on each power module:

- If the Pwr OK indicator is on and the Fault indicator is off on each power module, it indicates that the fan tray is receiving +12 VDC:
  - If the fan tray is still not functioning, there could be a problem with the fan tray controller card or an undetected problem in the fan tray cable. Replace the fan tray.
  - If the new fan tray does not function, contact a Cisco customer service representative for assistance.
- If the Fault indicator is on, the power supply is faulty. Replace the power supply.
- If the Temp and Fault indicators are on, an over-temperature condition exists:
  - Verify that the power supply fan is operating properly.
  - If the fan is not operating, replace the power supply.
  - Contact your Cisco representative if replacing the power supply does not fix the problem.

CHAPTER 5

Replacing Cisco ASR 9001 Router Components

The router is equipped as ordered and is ready for installation and startup when it is shipped. As network requirements change, you may need to upgrade the system by adding or changing components. This chapter describes how to maintain router components.

Procedures for maintaining the router are described in these sections:

Prerequisites and Preparation

Before you perform any of the procedures in this chapter, be sure that you:

- Review the "Safety Guidelines" section on page 1-2.
- Read the safety and ESD-prevention guidelines described in the "Compliance and Safety Information" section on page 1-3.
- Ensure that you have all the necessary tools and equipment before beginning the procedure.
- Have access to these documents during the installation:
  - *Regulatory Compliance and Safety Information for the Cisco ASR 9000 Aggregation Services Router* publication that shipped with the router.

Field Replaceable Units

These components are field replaceable units (FRUs):

- Chassis
- Power modules
- Fan tray
- Gigabit Ethernet small form-factor pluggable transceiver modules (SFPs)
- 10-Gigabit Ethernet small form-factor pluggable transceiver modules (XFPs)

Online Insertion and Removal

The Cisco ASR 9000 Series Router field-replaceable units (FRUs) can be removed and replaced with the power on and the system operating. This facility is known as *online insertion and removal* (OIR). Unless otherwise noted, the maintenance tasks described in this chapter can be performed while the router remains powered on.

Powering Off the Router

If it becomes necessary to turn all power off to the router, use this procedure:

Step 1 Power off all circuit breakers for the source power lines connected to the power modules.

Step 2 Verify that the power OK indicator on each power module is off.

Step 3 Verify that the STATUS indicator on the fan tray is off.

Removing and Replacing the Fan Tray

Use these procedures to remove and replace the fan tray:

Note The OIR of the fan tray is supported from Cisco IOS XR Release 4.2.3.

Caution To prevent automatic shutdown of the system, be sure to power off the router before removing fan tray.

Warning **Be sure that the fans have stopped running before removing the fan tray. The fans can take from 3 to 5 seconds to completely stop running after disengaging the fan tray latch. Handling the fan tray before the fans have stopped running could cause fingertip injury.**

To remove a fan tray from the chassis (see Figure 5-1):

Step 1 Power off the router.

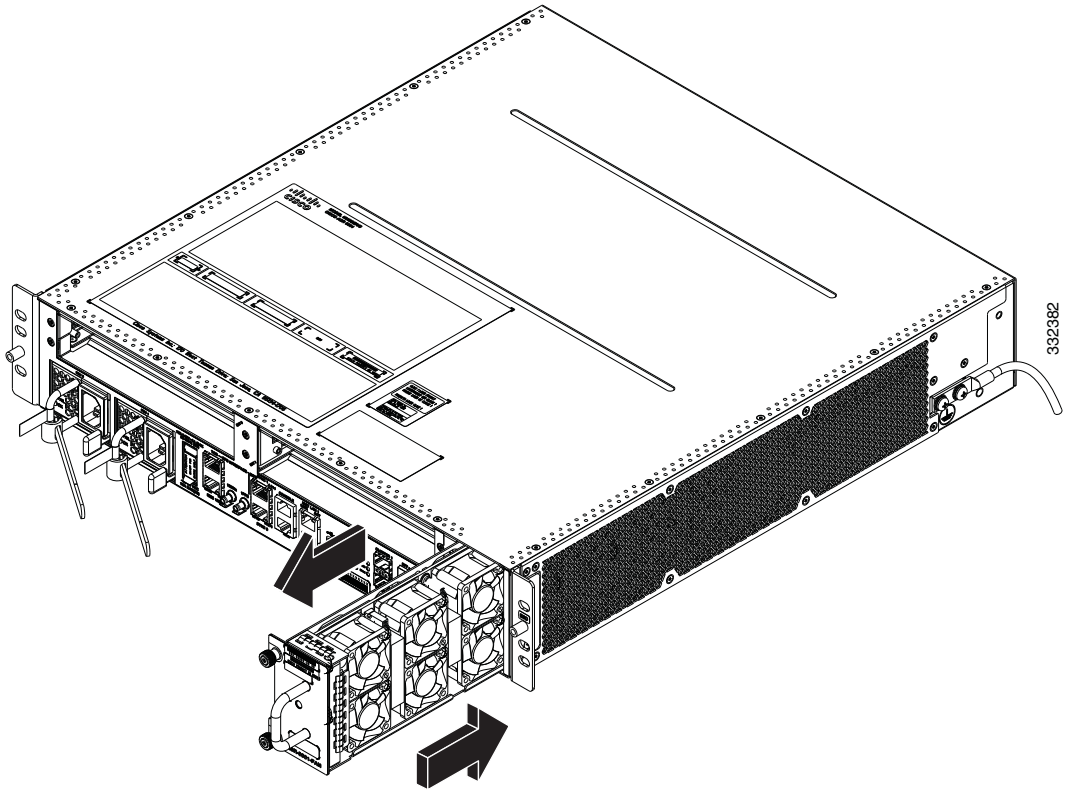
Step 2 Loosen the captive screw(s) that secure the fan tray.

Step 3 Use the handle on the fan tray front panel to pull the fan tray halfway out of the module bay.

Step 4 Slide out the fan tray completely from the chassis while supporting it with your other hand.

Warning **The fan tray weighs approximately 2.6 pounds (1.2 kg). Use both hands when handling the fan tray.**

Figure 5-1 Removing or Installing the Fan Tray on the Cisco ASR 9000 Series Router Chassis



To install a fan tray into the chassis:

Step 1 Lift the fan tray (with two hands) and slide it halfway into the module bay.

Step 2 Slowly push the fan tray into the chassis until it mates with the backplane connector at the back of the module bay.

Caution To prevent damage to the connectors, do not use excessive force when inserting the fan tray into the chassis.

Step 3 Tighten the captive screw(s) on the fan tray to a torque of 10 +/–1 in-lb to secure it to the chassis.

Step 4 Verify that the (green) OK status indicator on the front of the fan tray goes on. If the OK indicator does not light, see the "Troubleshooting the Cooling Subsystem" section on page 4-18.

Removing and Replacing AC or DC Power System Components

This section contains removal and replacement procedures for the AC and DC power systems used in the Cisco ASR 9000 Series Router.

Power Module Replacement Guidelines

The Cisco ASR 9000 Series Router support online insertion and removal (OIR) for power modules. If you are replacing a redundant power module, you can remove and install the power module while the system remains powered on without causing an electrical hazard or damage to the system. This feature enables you to replace a power module while the system maintains all routing information and ensures session preservation.

However, to maintain operational redundancy and proper cooling, and to meet EMI compliance standards, you must have at least one working power module installed (more than one for a fully configured system). When you remove a failed power module with the router in operation, perform the replacement as soon as possible. Make sure you have the replacement power module ready before beginning the removal and installation procedure.

Removing and Replacing an AC or DC Power Module

This section contains the procedure to remove and replace an AC or DC power module from the chassis.

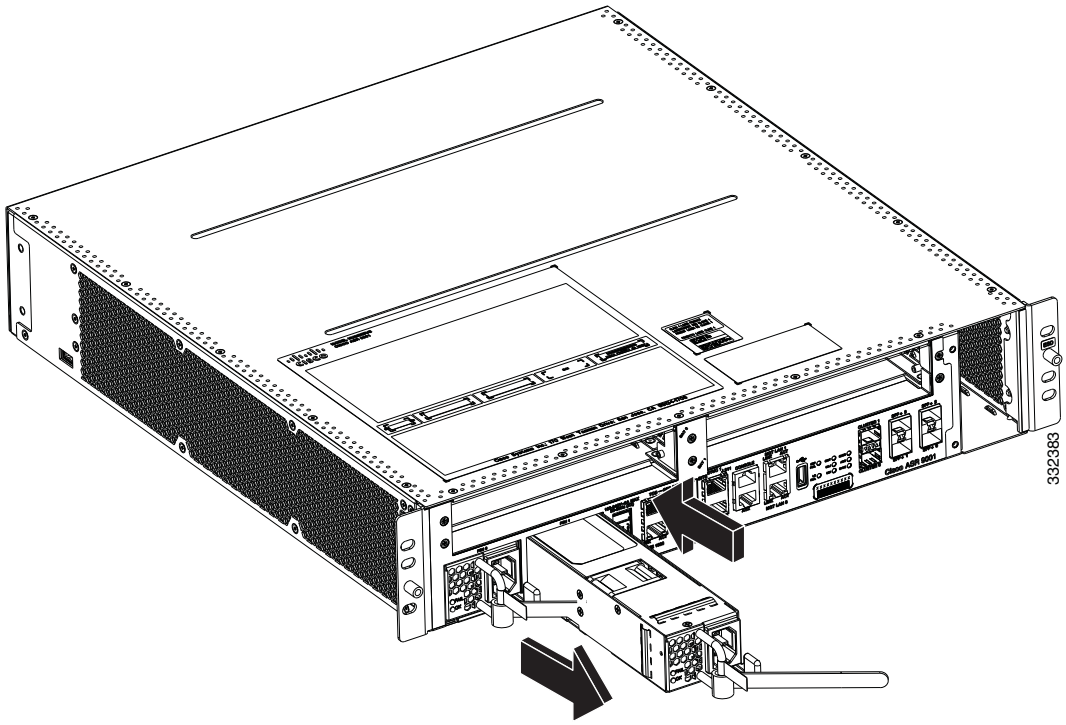
Removing an AC or DC Power Module

To remove an AC or DC power module from the chassis (see Figure 5-2):

Step 1 Pull the keying lever towards left side to unlock the module from the chassis.

Step 2 Slide the power module out of its bay while supporting it with your other hand.

Figure 5-2 Removing or Installing an AC or DC Power Module



Installing an AC or DC Power Module

To install an AC or DC power module (see Figure 5-2):

Step 1 Slide the power module into the bay until it mates with its backplane connector.

Step 2 Make sure that keying lever locks with the chassis.

Step 3 Verify that the OK (green) power indicator on the front of the power module comes ON. If the indicator does not light up, see the "Troubleshooting the Power Subsystem" section on page 4-3.

Removing a Chassis from the Equipment Rack

Use this procedure to remove the chassis and its components from the equipment rack:

Warning **You must use two people to remove the chassis from the equipment rack safely. An empty chassis can weigh up to approximately 24.69 pounds (11.2 kg).**

Step 1 Power off the router (see the "Powering Off the Router" section on page 5-2).

Step 2 Power off the circuit breakers to the power supplies.

Step 3 Disconnect the power from the power modules on the front of the chassis:

Step 4 Disconnect the supplemental bonding and grounding connection from the chassis (see the "Supplemental Bonding and Grounding Connections" section on page 2-7).

Step 5 Disconnect RP cables connected to the console port, auxiliary port, or either of the management Ethernet ports.

Be sure to label each of the RP cables before you disconnect the cables.

Step 6 Disconnect the line card interface cables.

Step 7 Remove the chassis from the rack.

a. Remove the screws that attach the chassis rack mount flanges and the side rack mount brackets to the rack posts.

b. Carefully lift the chassis out of the rack and set it aside.

Installing a Replacement Chassis in the Equipment Rack

Use this procedure to install the replacement chassis and components in the equipment rack:

Step 1 Install the new chassis in the rack (see the "Rack-Mounting the Router Chassis" section on page 2-4).

Step 2 Connect all line card and interface cables (see the "Connecting Route Processor Cables" section on page 3-16).

Step 3 Connect the supplemental bonding and grounding connection (if there is one) to the chassis (see the "Supplemental Bonding and Grounding Connections" section on page 2-7).

Step 4 Connect power to the power modules on the front of the chassis.

Step 5 To turn on power to the router, see the "Powering on the Router" section on page 3-21.

Packing a Chassis for Shipment

Use the packaging that came with the replacement chassis to repack and ship the chassis being replaced.

APPENDIX A

Technical Specifications

This appendix lists certain technical specifications for the Cisco ASR 9001 Router.

The specifications are presented in these tables:

Table A-1 lists the physical specifications for the Cisco ASR 9001 Router.

Table A-1 Cisco ASR 9001 Router Physical Specifications

Description	Value
Chassis height	3.46 in. (8.79 cm)
Chassis width	17.42 in. (44.2 cm)
Chassis depth	18.5 in. (47.0 cm)
Chassis weight	
• Chassis only[1]	24.69 pounds (11.2 kg)
• Chassis: fully configured with two MPAs, two power modules, and one fan tray	37.91 pounds (17.2 kg)

1. Chassis only does not include cards, power modules, fan tray, or chassis accessories.

Table A-2 lists the environmental specifications for the Cisco ASR 9001 Router.

Table A-2 Cisco ASR 9001 Router Environmental Specifications

Description	Value
Operating Temperature (Nominal):	41° to 104°F (5° to 40°C)
Operating Temperature (Short term)[1]:	23° to 131° F (–5° to 55°C)
Humidity	Operating: 10 to 85 percent noncondensing Nonoperating: 5 to 95 percent noncondensing
Altitude	Operating: 0 to 13,000 ft (0 to 4,000 m) Nonoperating: 0 to 15,000 ft (0 to 4,570 m)
Power Dissipation	750 W maximum
Acoustic noise	70 dB at 80.6°F (27°C) maximum
Shock	Operating (halfsine): 21 in/sec (0.53 m/sec) Nonoperating (trapezoidal pulse): 20 G^2, 52 in/sec (1.32 m/sec)
Vibration	Operating: 0.35 Grms[3] from 3 to 500 Hz Nonoperating: 1.0 Grms from 3 to 500 Hz

1. Short-term refers to a period of not more than 96 consecutive hours, and a total of no more than 15 days in a year. (This refers to a total of 360 hours in any given year, but no more than 15 occurrences during that 1-year period.).
2. G is a value of acceleration, where 1G equals 32.17 ft/sec^2 (9.81 m/sec^2).
3. Grms is the root mean square value of acceleration.

Table A-3 lists the AC electrical specifications for the Cisco ASR 9001 Router.

Table A-3 Cisco ASR 9001 AC Electrical Specifications

Description	Value
Power modules per system	Up to two AC power modules per system
Total AC input power	765 VA (volt-amps) per AC power supply (up to two AC power supply modules per system)
Rated input voltage[1]	100–240 VAC nominal (range: 90 to 264 VAC) 220–240 VAC (UK)
Rated input line frequency[1]	50/60 Hz nominal (range: 47 to 63 Hz) 50/60 Hz (UK)
Input current rating[1]	15 A maximum at 100 VAC 13 A maximum at 220 to 240 VRMS (UK)
Source AC service requirement[1]	15 A North America and Japan; 10 A international; 13 A UK
Redundancy	Power redundancy requirements vary, based on system configuration (number and type of line cards, etc). AC powered systems are 2N protected and DC powered systems are N+1 protected.

1. For each AC power supply module.

Caution Be sure that the chassis configuration complies with the required power budgets. Failure to properly verify the configuration may result in an unpredictable state if one of the power units fails. Contact your local sales representative for assistance.

Table A-4 lists the DC electrical specifications for the Cisco ASR 9001 Router.

Table A-4 Cisco ASR 9001 DC Electrical Specifications

Description	Value
Power modules per system	Up to two DC power modules per system
Total DC input power per power module	750 W
Rated input voltage per power module	–48 VDC nominal in North America –60 VDC nominal in the European Community (range: –40.5 to –72 VDC [–75 VDC for 5 ms])
Input current rating[1]	15 A maximum at –48 VDC nominal 15 A maximum at –60 VDC nominal
Source DC service requirement[1]	Sufficient to supply the rated input current. Local codes apply.
Redundancy	Power redundancy requirements vary, based on system configuration (number and type of line cards, etc). AC powered systems are 2N protected and DC powered systems are N+1 protected.

1. For each DC power supply module. Some power/chassis configurations may operate at lower current ratings than those specified in this table. Contact your Cisco technical representative for more information.

Table A-5 lists the AC input voltage range for the AC-powered Cisco ASR 9001 Router (single phase power source).

Table A-5 AC Input Voltage Range

Range	Minimum	Minimum Nominal	Nominal	Maximum Nominal	Maximum
Input Voltage	90 VAC	100 VAC	220 VAC	240 VAC	264 VAC
Line Frequency	47 Hz	50 Hz	50/60 Hz	60 Hz	63 Hz

Table A-6 lists the DC input voltage range for the DC-powered Cisco ASR 9001 Router.

Table A-6 DC Input Voltage Range

Range	Minimum	Nominal	Maximum
Input Voltage	–40 VDC	–48 VDC	–72 VDC

Table A-7 lists the DC output tolerances for either AC or DC power modules.

Table A-7 DC Output Levels for ASR 9001 Power System

Parameter	Value
Voltage	
Maximum	12.6 VDC
Nominal	12 VDC
Minimum	11.4 VDC
Power	
Minimum (one power module)	750 W
Maximum (two 750 W power modules)	1500 W

Table A-8 lists the RP port specifications.

Table A-8 RP Port Specifications

Description	Value
Console port	EIA/TIA-232 RJ-45 interface, 115200 Baud, 8 data, no parity, 1 stop bit with software handshake (default)
Auxiliary port	EIA/TIA-232 RJ-45 interface, 115200 Baud, 8 data, no parity, 1 stop bit with software handshake (default)
Management ports (0, 1)	Triple-speed (10M/100M/1000M) RJ-45
Sync ports (0, 1)	Can be configured as one of the following: • BITS (Building Integrated Timing System) port • J.211 or UTI (Universal Timing Interface) port

Table A-9 lists the power consumption specifications for a fully configured chassis.

Caution Be sure that the chassis configuration complies with the required power budgets. Failure to properly verify the configuration may result in an unpredictable state if one of the power units fails. Contact your local sales representative for assistance.

Table A-9 Cisco ASR 9001 Router Chassis Power Consumption Specifications

Description	Value
Power consumption	400 W at 77°F (25°C)
	425 W at 104°F (40°C)
	450 W at 131°F (55°C)

Table A-10 lists the supported Gigabit Ethernet SFP modules and describes their operating parameters.

Table A-10 Supported Fast Ethernet and Gigabit Ethernet SFP Modules

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
Supported Trirate Copper SFPs				
SFP-GE-T	Transceiver Module for Category 5 copper wire	n/a	Copper	328.08 feet (100 m)
Supported Gigabit Ethernet SFPs				
GLC-GE-100FX	100BASE-FX SFP for Gigabit Ethernet ports	1310 nm	MMF	1.24 miles (2 km)
GLC-BX-D	1000BASE-BX SFP	1490 nm TX 1310 nm RX	SMF	6.2 miles (10 km)
GLC-BX-U	1000BASE-BX SFP	1310 nm TX 1490 nm RX	SMF	6.2 miles (10 km)
GLC-SX-MMD	1000BASE-SX Short Reach (DOM)	850 nm	MMF	984.25 feet (300 m)
GLC-LH-SMD	1000BASE-LX/LH Long Reach (DOM)	1310 nm	SMF	6.21 miles (10 km)
GLC-EX-SMD	1000BASE-EX Long Reach (DOM)	1310 nm	SMF	24.85 miles (40 km)
GLC-ZX-SMD	1000BASE-ZX Extended Reach (DOM)	1550 nm	SMF	49.7 miles (80 km)

Table A-11 lists the supported 10-Gigabit Ethernet SFP+ transceivers modules and describes their operating parameters.

Table A-11 Supported SFP+ Transceivers

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
SFP-10G-ER	Cisco SFP+ for 10-Gigabit Ethernet Extended Reach	1550 nm	SMF	24.85 miles (40 km)

Table A-11 Supported SFP+ Transceivers (continued)

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
SFP-10G-LR	Cisco SFP+ for 10-Gigabit Ethernet Long Reach	1310 nm	SMF	6.21 miles (10 km)
SFP-10G-SR	Cisco SFP+ for 10-Gigabit Ethernet Short Reach	850 nm	62.5 micron (FDDI grade)	82.02 feet (25 m)
			62.5 micron (OM1 grade)	65.62 feet (20 m)
			50 micron (OM2 grade)	262.47 feet (80 m)
			50 micron (OM3 grade)	984.25 feet (300 m)

Table A-12 lists the supported CWDM SFP transceivers modules and describes their operating parameters.

Table A-12 Supported CWDM SFP Transceivers

Part Number	Description	Wavelength	Fiber Type	Color Identifier
CWDM-SFP-1470	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1470 nm	SMF	Gray
CWDM-SFP-1490	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1490 nm	SMF	Violet
CWDM-SFP-1510	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1510 nm	SMF	Blue
CWDM-SFP-1530	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1530 nm	SMF	Green
CWDM-SFP-1550	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1550 nm	SMF	Yellow
CWDM-SFP-1570	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1570 nm	SMF	Orange
CWDM-SFP-1590	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1590 nm	SMF	Red
CWDM-SFP-1610	Cisco CWDM SFP for Gigabit Ethernet and 1G/2G FC	1610 nm	SMF	Brown

Table A-13 lists the supported DWDM SFP transceivers modules and describes their operating parameters.

Table A-13 Supported DWDM SFP Transceivers

Part Number	Description	Wavelength	ITU Grid
DWDM-SFP-5979	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1559.79 nm	22
DWDM-SFP-5898	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1558.98 nm	23
DWDM-SFP-5817	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1558.17 nm	24
DWDM-SFP-5736	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1557.36 nm	25
DWDM-SFP-5655	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1556.55 nm	26
DWDM-SFP-5575	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1555.75 nm	27
DWDM-SFP-5494	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1554.94 nm	28
DWDM-SFP-5413	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1554.13 nm	29
DWDM-SFP-5332	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1553.32 nm	30
DWDM-SFP-5252	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1552.52 nm	31
DWDM-SFP-5172	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1551.72 nm	32

Table A-13 Supported DWDM SFP Transceivers (continued)

Part Number	Description	Wavelength	ITU Grid
DWDM-SFP-5092	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1550.92 nm	33
DWDM-SFP-5012	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1550.12 nm	34
DWDM-SFP-4931	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1549.31 nm	35
DWDM-SFP-4851	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1548.51 nm	36
DWDM-SFP-4772	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1547.72 nm	37
DWDM-SFP-4692	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1546.92 nm	38
DWDM-SFP-4612	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1546.12 nm	39
DWDM-SFP-4532	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1545.32 nm	40
DWDM-SFP-4453	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1544.53 nm	41
DWDM-SFP-4373	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1543.73 nm	42
DWDM-SFP-4294	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1542.94 nm	43
DWDM-SFP-4214	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1542.14 nm	44
DWDM-SFP-4134	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1541.34 nm	45
DWDM-SFP-4056	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1540.56 nm	46
DWDM-SFP-3977	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1539.77 nm	47
DWDM-SFP-3898	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1539.98 nm	48
DWDM-SFP-3819	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1538.19 nm	49
DWDM-SFP-3739	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1537.39 nm	50
DWDM-SFP-3661	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1536.61 nm	51
DWDM-SFP-3582	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1535.82 nm	52
DWDM-SFP-3504	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1535.04 nm	53
DWDM-SFP-3425	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1534.25 nm	54
DWDM-SFP-3346	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1533.46 nm	55
DWDM-SFP-3268	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1532.68 nm	56
DWDM-SFP-3190	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1531.90 nm	57
DWDM-SFP-3112	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1531.12 nm	58
DWDM-SFP-3033	Cisco 1000BASE-DWDM SFP (100 GHz ITU grid)	1530.33 nm	59

Caution Use only the SFP modules supplied by Cisco Systems, Inc. with your Ethernet line card. Each SFP module contains an internal serial EEPROM that is security-programmed by the SFP manufacturer with information that provides a way for Cisco IOS XR software to identify and validate the SFP module to operate properly with Cisco Ethernet line cards. Unapproved SFP modules (those not purchased directly from Cisco Systems, Inc.) do not work on the Ethernet line card.

Table A-14 lists the supported 10-Gigabit Ethernet XFP modules and describes their operating parameters.

Note Version V01 and V02 of the XFP-10GLR-OC192SR 10-Gigabit Ethernet module listed in Table A-14 are not supported.

Note Version V01 and V02 of the XFP-10GZR-OC192LR 10-Gigabit Ethernet module listed in Table A-14 is not supported.

Table A-14 Supported 10-Gigabit Ethernet XFP Modules

Part Number	Description	Wavelength	Fiber Type	Typical Maximum Distance
XFP-10GLR-OC192SR (Version V03, see note)	Multirate 10GBASE-LR and OC-192/STM-64 SR-1 XFP	1310 nm	SMF	6.2 miles (10 km) 10-Gigabit Ethernet 1.24 miles (2 km) OC-192/STM-64 SR1
XFP-10GER-192IR+	Multirate 10GBASE-ER and OC-192/STM-64 IR-2 XFP	1550 nm	SMF	40 km (24.85 miles)
XFP-10GZR-OC192LR (Version V03, see note)	Multirate 10GBASE-ZR and OC-192/STM-64 LR-2 XFP	1550 nm	SMF	49.70 miles (80 km)
XFP-10G-MM-SR	Multirate 10GBASE-SR	850 nm	MMF	85.3 to 984.3 feet (26 m to 300 m)

Table A-15 lists the supported DWDM XFP transceivers modules and describes their operating parameters.

Table A-15 Supported DWDM XFP Transceivers

Part Number	Description	Wavelength	ITU Grid
DWDM-XFP-60.61	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1560.61 nm	21
DWDM-XFP-59.79	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1559.79 nm	22
DWDM-XFP-58.98	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1558.98 nm	23
DWDM-XFP-58.17	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1558.17 nm	24
DWDM-XFP-56.55	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1556.55 nm	26
DWDM-XFP-55.75	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1555.75 nm	27
DWDM-XFP-54.94	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1554.94 nm	28
DWDM-XFP-54.13	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1554.13 nm	29
DWDM-XFP-52.52	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1552.52 nm	31
DWDM-XFP-51.72	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1551.72 nm	32
DWDM-XFP-50.92	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1550.92 nm	33
DWDM-XFP-50.12	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1550.12 nm	34
DWDM-XFP-48.51	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1548.51 nm	36
DWDM-XFP-47.72	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1547.72 nm	37
DWDM-XFP-46.92	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1546.92 nm	38

Table A-15 Supported DWDM XFP Transceivers (continued)

Part Number	Description	Wavelength	ITU Grid
DWDM-XFP-46.12	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1546.12 nm	39
DWDM-XFP-44.53	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1544.53 nm	41
DWDM-XFP-43.73	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1543.73 nm	42
DWDM-XFP-42.94	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1542.94 nm	43
DWDM-XFP-42.14	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1542.14 nm	44
DWDM-XFP-40.56	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1540.56 nm	46
DWDM-XFP-39.77	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1539.77 nm	47
DWDM-XFP-38.98	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1539.98 nm	48
DWDM-XFP-38.19	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1538.19 nm	49
DWDM-XFP-36.61	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1536.61 nm	51
DWDM-XFP-35.82	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1535.82 nm	52
DWDM-XFP-35.04	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1535.04 nm	53
DWDM-XFP-34.25	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1534.25 nm	54
DWDM-XFP-32.68	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1532.68 nm	56
DWDM-XFP-31.90	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1531.90 nm	57
DWDM-XFP-31.12	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1531.12 nm	58
DWDM-XFP-30.33	Cisco 10GBASE-DWDM XFP (100 GHz ITU grid)	1530.33 nm	59
DWDM-XFP-C	Cisco 10GBASE-DWDM Tunable XFP (50-GHz ITU grid) 80 Channels	Variable	Variable

APPENDIX B

Site Log

The site log provides a historical record of all operation and maintenance actions performed on the router. Keep your site log at a convenient place near the router where it can be easily accessed.

The site log might include these entries:

- Installation progress—Make entries in the site log to record installation progress. Note any difficulties and remedies during the installation process.
- Upgrades or removal and replacement procedures—Use the site log as a record of router maintenance and expansion history.

  Each time a procedure is performed on the router, update the site log to record these:

  - Any field replaceable unit (FRU) that is installed, removed, or replaced
  - Any router configuration changes
  - Software upgrades
  - Corrective or preventive maintenance procedures performed
  - Intermittent problems
  - Related comments

A sample site log format is provided in the next page. You can make copies of the sample, or design your own site log page to meet the customized needs of your site and equipment.

Date	Description of Action Performed or Symptoms Observed	Initials

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